RADIO & TELEVISION NEWS

WTMJ's MOBILE TELEVISION UNIT

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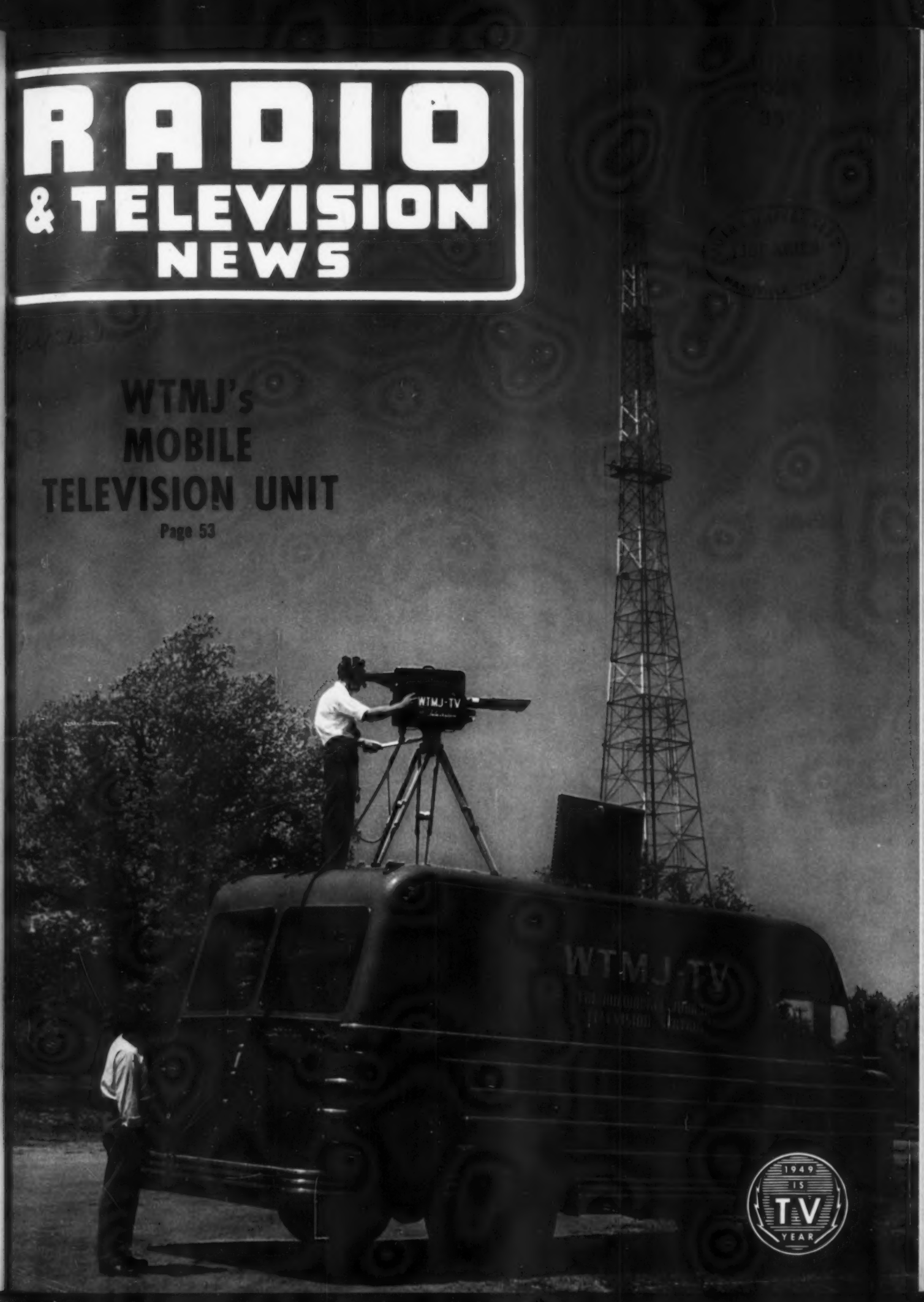
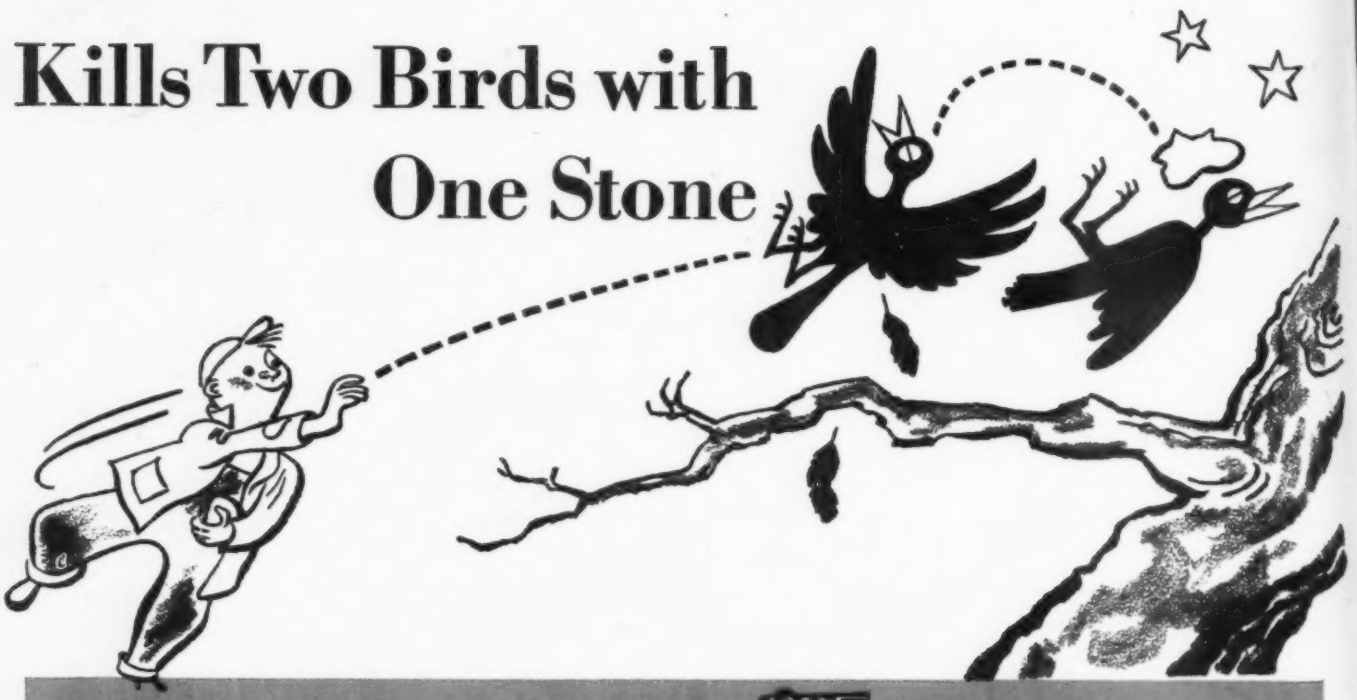
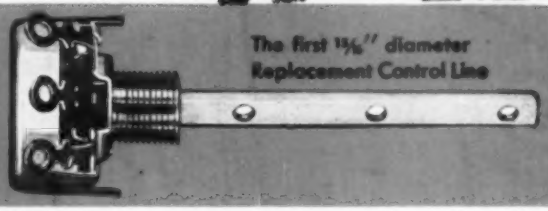


Kills Two Birds with One Stone



The Mallory Midgetrol



You win *two* ways with the amazing Mallory Midgetrol.

First, it is ideal for servicing auto radios, portables and other sets requiring small size controls. Second, its husky electrical capacity allows you to use it in sets originally equipped with older, bulkier controls.

So when you stock the Mallory Midgetrol, you're actually able to handle more jobs with a smaller inventory. That's important these days.

LOOK WHAT THE MALLORY MIDGETROL OFFERS:

WIDER APPLICATION—The small size allows you to service portables, auto radios and small AC-DC receivers requiring 15/16" controls.

SIMPLER INSTALLATION—The new and unique flat shaft design of the Mallory Midgetrol saves installation time with *all* types of knobs.

LESS INVENTORY—Electrical characteristics allow you to use the Mallory Midgetrol to replace 1⅛" as well as 15/16" controls. Since no special shafts are required, you carry fewer controls in stock.

NEW SIZE	NEW SHAFT	NEW SWITCH	NEW CONTACT
NEW DESIGN	NEW EXTENSION	NEW ELEMENT	NEW TERMINAL

NEW TWO-POINT SUSPENSION

See your Mallory Distributor for this new standard in carbon controls

P.R. MALLORY & CO. Inc.

MALLORY

CAPACITORS . . . CONTROLS . . . VIBRATORS . . .
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VIBRAPACK* POWER SUPPLIES . . . FILTERS

*Reg. U. S. Pat. Off.

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COVER PHOTO: Equipped by RCA with a complete TV control room and portable cameras, the WTMJ-TV mobile unit goes "on location." (Staff photo by O. Read)

First in
radio-television-electronics
Average Paid Circulation over 181,000

RADIO & TELEVISION NEWS

Radio News Trade Mark Reg. U.S. Pat. Office No. 378427

CONTENTS — JUNE, 1949

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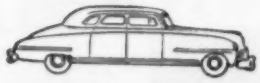
Which Do You Want?

Better Pay

A Nice Home



A New Car

Greater Security

Happy Vacations and Travel

Get Your FCC Ticket Jobs leading to $3,000 to $7,500
(Average Pay Reported by FCC Nationwide Survey)
are opening up right now for FCC Licensed Radiomen.

Add Technical Training to Your Practical Experience and

Get Your FCC COMMERCIAL RADIO OPERATOR LICENSE *in a Few Short Weeks*

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Get your license easily and quickly and be ready for the jobs open to ticket holders that lead to $3000 to $7500. CIRE training is the only planned course of coaching and training that leads directly to an FCC license.

YOUR FCC TICKET IS ALWAYS RECOGNIZED IN ALL RADIO FIELDS AS PROOF OF YOUR TECHNICAL ABILITY

CIRE Graduates Find FCC License Pays Off

"Transmitter engineering is great, especially in the job I am on. Thanks again for all you have done, and you can take the credit for the fact that my 'ticket' is now posted on the wall of a 1000 watt broadcast station."

Student No. 3678N12

"I now hold ticket P-10-3787, and holding the license has helped me to obtain the type of job I've always dreamed of having. Yes, thanks to CIRE, I am now working for CAA as Radio Maintenance Technician, at a far better salary than I've ever had before. I am deeply grateful."

Student No. 3319N12

"I took the FCC examination on March 4th, and received my second class radiotelephone license March 9th. I go to work for the Trans-Texas Airways in the maintenance department. Thanks for all the assistance."

Student No. 2394A1

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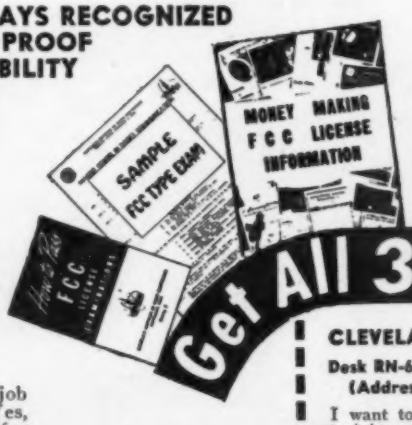
2. TELLS HOW YOU WILL BENEFIT BY HOLDING AN FCC COMMERCIAL LICENSE.
3. TELLS HOW YOU CAN GET YOUR FCC COMMERCIAL RADIO OPERATOR LICENSE IN A FEW SHORT WEEKS—EASILY AND QUICKLY, BY USING CIRE SIMPLIFIED TRAINING AND COACHING AT HOME IN YOUR SPARE TIME.
4. TELLS OF HUNDREDS OF OUR SUCCESSFUL STUDENTS WHO NOW HAVE LICENSES AND NEW, BETTER-PAYING JOBS.
5. TELLS HOW WE PREPARE YOU TO PASS THE NEW FCC COMMERCIAL LICENSE EXAMINATIONS, WHICH NOW INCLUDE FM AND TELEVISION.
6. TELLS HOW WE GUARANTEE TO TRAIN AND COACH YOU UNTIL YOU GET YOUR LICENSE.
7. TELLS HOW WE HELP YOU TO GET A BETTER-PAYING LICENSED JOB, WITH OUR FREE AND EXCLUSIVE SERVICE WHICH PREPARES YOUR EMPLOYMENT APPLICATION FOR MAILING TO HUNDREDS OF EMPLOYERS, INCLUDING FM, AM, AND TELEVISION BROADCAST STATIONS, RADIO MANUFACTURERS, POLICE RADIO STATIONS, AND RADIO-EQUIPPED TAXI, BUS AND PUBLIC UTILITY COMPANIES



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"Believe me, Ken-Rad Tubes have what it takes to keep customers satisfied. A satisfied customer is a steady customer —and steady customers mean faster turnover, more money in the till.

"There's no substitute for quality—that means there's no substitute for Ken-Rad Tubes!"

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ROBERT W. FIELD, Circuit Engineer, is in charge of special stroboscopic vibration test (below). This helps to determine the numerous tests Ken-Rad Tubes must pass before being approved and shipped to dealers.

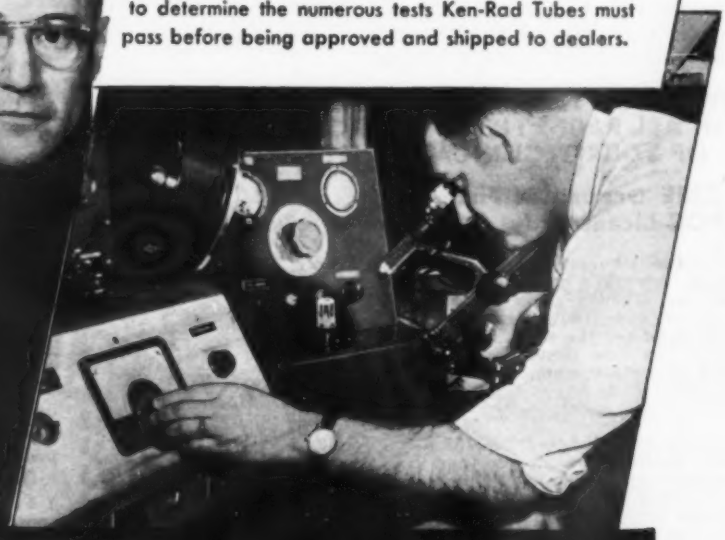
"From start to finish of production, Ken-Rad Tubes must pass one comprehensive test after another.

"These are based on work such as the special stroboscopic vibration check developed by General Electric engineers.

"Tubes are placed in a special spring-supported socket which is driven from a variable-frequency audio oscillator.

"A stroboscopic light then is used to illuminate the tube while it is studied for vibrating elements or loose parts under a high-power microscope.

"No wonder Ken-Rad Tubes satisfy customers!"



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For the RECORD

BY THE EDITOR

PUBLIC ENTITLED TO TVI CONTROL

INTERFERENCE created by automotive ignition systems is playing havoc in many areas with television sets. In fact, automotive TVI is probably the Number One source of headache to the set owners. Distorted and torn pictures are commonplace in television service areas, especially in the large metropolitan centers, where the streets and highways are jammed with these hash-creating "transmitters." Amateur mobile radio operators and other communications services have long been able to cope with the problem and have equipped their vehicles with various forms of suppressors, filters, and other gadgets designed to forestall radiation from the ignition systems. It is generally believed by the public that the addition of such accessories hinders the proper working of the auto engine. On the contrary, there are few complaints of poor engine performance resulting from such equipment.

Amateur radio operators have, for the past two years, been severely criticized by television set owners for causing interference with their video reception. Actually, only a small percentage of these complaints has been fully justified.

The FCC is required by law to take action against transmitter licensees whenever justifiable complaints arise as a result of an improperly adjusted transmitter which causes interference, so why shouldn't *any* radiated signal, including that from automotive equipment, also be controlled by the FCC and other authorities? There are literally millions of automobiles cruising our city streets and travelling our highways. Nearly all of these are, in a sense, portable transmitters. Not only are they capable of, and guilty of, transmitting multiple signals, but as any technician knows, each vehicle can transmit many signals at different frequencies at the same moment. Radiation from diathermy machines and other signal producing devices is controlled by law, and shielding and other methods of hash control are required of the owners. Why shouldn't the same apply to car owners? The British recognize the need for such control and enforce strict regulations on offenders and demand filters and any other remedies that may be indicated to prevent radiation from automotive equipment. Many cities in the United States have enacted laws against the use of horns and other noise-producing sources, but America is far behind in cleaning up the ever-present interference that is still plaguing all shortwave and television services.

Service technicians are being damned for improper installation and adjustment of television sets. In many cases, the disgruntled customer complains that the picture frequently streaks and otherwise distorts during a program. These technicians tell us that in most cases of this nature the interference was being caused by idling motors and from passing automobile traffic. Even with a highly efficient antenna installation the trouble often persists. Service technicians would save a large percentage of unnecessary calls if anti-hash legislation were enacted. Everyone would benefit, and the cost to the car owner would be a mere trifle by comparison. It's the job of the local newspaper press to present the facts accurately to its readers and insist that steps be taken by their local and state representatives to present this problem to the authorities and to demand concerted action, the same as was done in Britain. Television continues to grow in importance and in service and is expected eventually to replace many conventional radio services. It is about time something was done about this "hash" situation.

• • •

WARNING TO TELEVISION TECHNICIANS

AS WE go to press, an attempt has been made in Illinois to "railroad" an act to license and regulate the business of installing, servicing and repairing television receivers. A copy of this House Bill No. 702 has been obtained and studied by RADIO AND TELEVISION NEWS.

This bill, introduced *without any discussion* with the major elements of the industry, is in direct opposition to the welfare of television set owners and the industry. Representatives of this magazine will appear before the committee to argue the bill and to recommend major changes. Basically this bill favors certain "accredited television schools" inasmuch as the bill (as drafted) requires a minimum 36 weeks' course in television instruction.

Technicians should, in whatever state they reside, query their Representatives and find out whether or not similar bills are in the process of preparation within their states and, if they are, plan their attack accordingly. We will give you a further report on this bill in our next issue. O.R.

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An excellent, low cost all-channel TV antenna. Has separate dipole and reflector for the high and low bands. Two-section 6 ft. mast of sturdy aluminum tubing, with dipoles and reflectors of aluminum also. Complete, less only lead-in line. Shpg. wt., 8 lbs.

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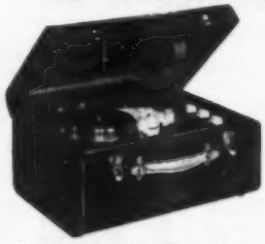

Knight Wire Recorder

Makes and plays high-quality wire recordings; plays any 10" or 12" 78 rpm disc recording; serves also as PA system or as wireless phono oscillator. Easy to operate. Ruggedly constructed. Complete in compact simulated leather case; with crystal handmike, playback pickup, all tubes, and 2 half-hour spools of wire. For 105-125 v., 60 cy. AC. Shpg. wt., 29 lbs.

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A top-grade tape recorder and playback unit at amazing low cost. May also be used as 6 watt PA system. Excellent frequency response. Easy to record; stable constant-speed mechanism. Exceptional playback quality. In sturdy portable case; with crystal handmike, 600 ft. reel of tape, take-up reel, and all tubes. For 105-125 v., 60 cy. AC. Shpg. wt., 36 lbs.

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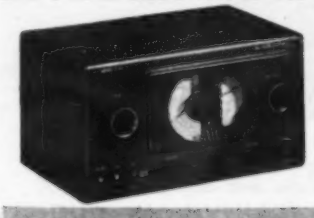
BIG PRICE REDUCTION ON FAMOUS HALLICRAFTERS S-38



A new low price for this all-star, all-wave value! Covers 4 full bands continuous from 540 kc. to 32 mc. Full electrical bandspread; noise limiter; band selector; BFO pitch; voice-code switch; speaker-headphones switch; standby-receive switch; latest PM speaker. In handsome 12 x 7 x 8" furniture-steel cabinet. Complete with tubes. For 105-125 v. AC or DC. Shpg. wt., 15 lbs.

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MODEL 12CL TV-FM KIT

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TV-FM KIT

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Includes Cabinet, Lens, Indoor or Outdoor Antenna, 60 ft. of Lead-in Wire. **$349**

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FREE ANTENNA: INDOOR or OUTDOOR type, with lead-in wire.

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*CHOICE of BEAUTIFUL CABINETS from $29

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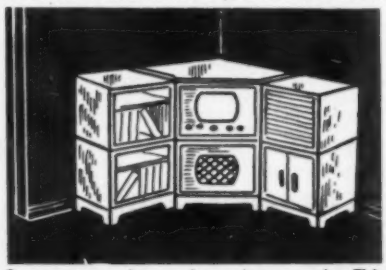
Transvision's "MODULAR" Cabinets come in knock-down, unpainted units, offering an unlimited range of combinations, including even a bar. Finish them off to suit your taste and need.



Corner piece, shown above, has room for **TV, Phono, Record Storage,** and open **Book Case. COMPLETE..... $84.00**

For other units and prices, write for "Modular" Catalog.

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Improves Installations!!

Saves ½ the Work!!

Has numerous features and advantages, including—(1) Measures actual picture signal strength . . . (2) Permits actual picture signal measurements without the use of a complete television set . . . (3) Antenna orientation can be done exactly . . . (4) Measures losses or gain of various antenna and lead-in combinations . . . (5) Useful for checking receiver re-radiation (local oscillator) . . . (6) **12 CHANNEL SELECTOR** . . . (7) Amplitudes of interfering signals can be checked . . . (8) Weighs only 5 lbs. . . . (9) **Individually calibrated** . . . (10) Housed in attractive metal carrying case . . . (11) Initial cost of this unit is covered after only 3 or 4 installations ....(12) Operates on 110V, 60 Cycles, A.C.

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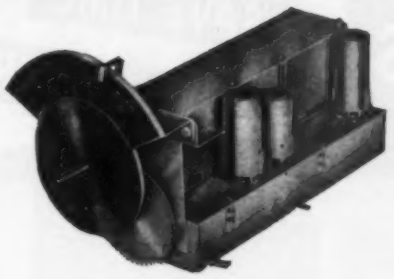
Model B-1 . . . . . **List $32.50**



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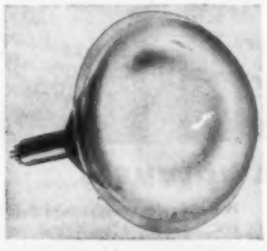

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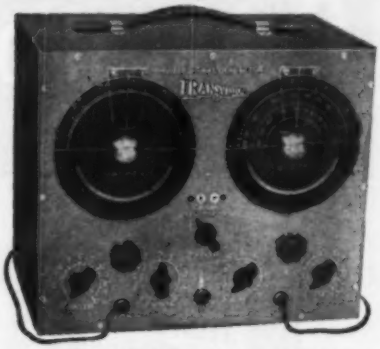

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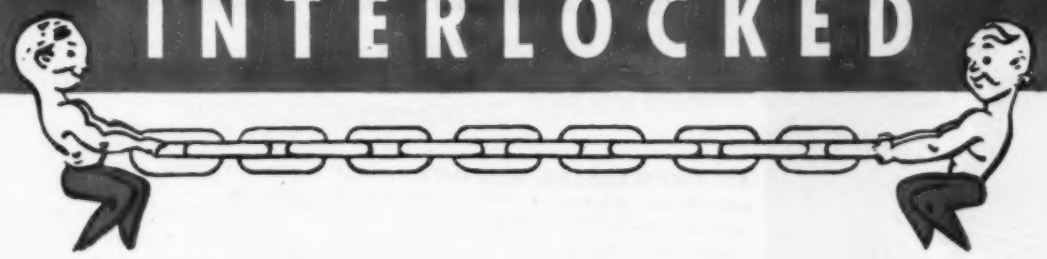

The principle of *interlocking* is simple—and complete assurance of maximum strength. For example, you'd naturally prefer a tire chain which is *interlocked* with equally strong links to one with its links taped or tied together. For the same reason both you . . . and your customers . . . will prefer OLIN flat cell "B" batteries since they have triple-sealed, equally-strong, *interlocked* flat cells . . . instead of ordinary cells bound together with paper tapes or other types of wrapping.

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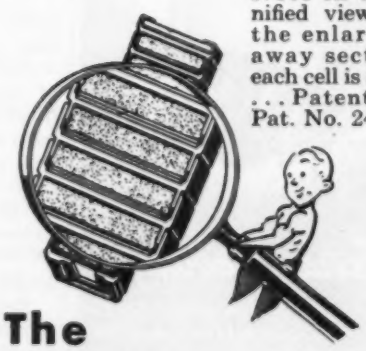

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By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

AN IMPRESSIVE REPORT on the significant advancements in communications services, presented by FCC chairman Wayne Coy at the annual luncheon-meeting of the Armed Forces Communications Association in Washington, revealed that motorists and train, ship, and plane passengers can now telephone to practically anywhere in the nation, thanks to the two-way radiotelephone systems. Coy said that 7000 cars are now equipped with two-way apparatus providing tie-ins with regular telephone switchboards and contact to any telephone in the country, fourteen trains have phone service, and 11,000 vessels and 150 planes also have two-way units, which provide local and long-distance communications.

The use of the two-way setups by the utilities and petroleum industries was also emphasized by Coy, who pointed out that there are more than 26,000 two-way equipped utility trucks which have consistently demonstrated the invaluable aid provided by the field and office radio link by accelerating repair to damages in water and gas mains and electric and telephone lines. The oil companies not only have radio-equipped trucks, but walkie-talkies and two-way plane service to patrol their pipelines and provide immediate dispatching of crews in case of leaks or explosions.

"In all, we have authorized two-way radio for some 200,000 vehicles," said Coy.

Amateur radio received quite a bit of applause, too, at the Washington luncheon-meeting, Coy declaring that ham service, which has served the nation so well in past disasters and has been such an effective training school for military and industry personnel, is growing steadily. Today there are 78,000 active hams, an increase of 18,000 since the war.

Describing how these new and expanding services can benefit the nation during an emergency, Coy said that an unparalleled closely-woven link could be rapidly established in hamlets, towns, cities, and states from coast to coast via the fixed and mobile stations which now span the country. He pointed out that . . . "No nation in history has ever been so well equipped with civilian communications facilities —facilities to promote our efficiency, comfort, and enjoyment in peace and our national security in the event of attack."

In a tribute to the outstanding services of the wartime government agencies, Coy praised the famous RID (Radio Intelligence Division), which was headed by George Sterling, now a FCC Commissioner, and which played so vital a role in tracking down clandestine tranmitters. He cited the case of the secret transmitter hidden in the German Embassy in Washington which the RID located, and the hundreds of other unlicensed transmitters traced and taken off the air. At its peak during the war RID had twelve primary stations and ninety secondary setups in this country, Puerto Rico, Alaska, and Hawaii. Today the FCC has ten primary stations, eleven secondary stations, and seventeen mobile direction finders, which are very active. Coy reported that the monitors are now locating illegal transmitters at the rate of about 150 a year. Horse racing gamblers appear to be giving the FCC monitor boys plenty of headaches. The monitors have also been of assistance to pilots, last year over 170 lost planes obtaining their bearings from the FCC posts. Captain William Odom, on his sensational light-plane flight from Honolulu to Newark, N. J., also benefited from the FCC monitor service. According to Coy, as a result of the FCC monitor fix, Odom discovered that he was 300 miles off his course while he was in the middle of the Pacific.

Listening in to Coy's spirited comments were the nation's outstanding government and industry radio specialists: Major General F. L. Ankerbrandt, U. S. Air Force Director of Communications; Brig. General David Sarnoff, chairman of the board of *RCA;* Rear Admiral E. E. Stone, U. S. Navy Chief of Naval Communications; Major General Spencer B. Akin, Chief Signal Officer of the Army; Fred R. Lack, vice president of *Western Electric* and president-elect of AFCA; and the internationally-famous communications legislator, Senator Wallace H. White, who retired last June.

AT THE ANNUAL NAB conference in Chicago, the FCC chairman appeared at a luncheon-meeting of broadcasters, disclosing this time the progress achieved by TV.

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"The trend is toward television . . . and there is no doubt that TV and sound are entering into a period of intensive competition," Coy declared.

Coy reported that television is the dominant medium of broadcasting in the future. "It is a new force unloosed in the land," he said.

Continuing with his enthusiastic comments on TV, Coy stated, "I believe it is an irresistible force. It is a technological discovery that the people want and demand. It is not something that you have to high-pressure the people into buying. In metropolitan areas, television has met with sensational acceptance.

"But don't think that the people outside of the metropolitan areas are going to be content to grow old gracefully while TV passes them by," Coy warned the broadcasters. "The day of the hinterland, the provinces, the backwoods, and the 'sticks' has passed in America. Radio itself helped hurry that process. The wartime prosperity and the dispersion of our industrial plants took us further along the road toward greater equality of opportunity."

And then Coy drove into the topic that has been a headline for many, many months, the ultra-highs, with the chairman disclosing that before many months, there'll be ultra-high allocations which will open up a new frontier of the spectrum . . . "so that it may be possible, given imaginative leadership . . . to take television service to all of America."

In a previous talk at Baltimore, Coy reemphasized his comment that the standard twelve-channel very-high band would remain, with the statement: "Present television sets available on the market will get service from these channels continuously. . . . I think the question of obsolescence of television receivers is something of a tempest in a teapot. I do not think that any one buying a television set today will have a fraud perpetrated upon him. I can assure them that wherever a television signal is available from a very-high transmitter, their sets will render them fine service for many years."

Amplifying Coy's opinions, Dr. Thomas T. Goldsmith, Jr., director of research for *DuMont*, reported at the NAB Chicago meeting, that if and when the ultra-highs come, the public will be able to buy, at a moderate price, converters which will bring the additional channels to their sets. He reported that such converters have been developed and found very satisfactory during tests.

Discussing the characteristics of ultra-high reception, Goldsmith said that ultra-high pictures will probably be of a higher quality because of the reduction in man-made interference and ghosts at these frequencies.

During an interview, Goldsmith stated that ultra-high stations, allocated on a 300-mile separation basis now, could provide an immediate serv-

(*Continued on page* 128)

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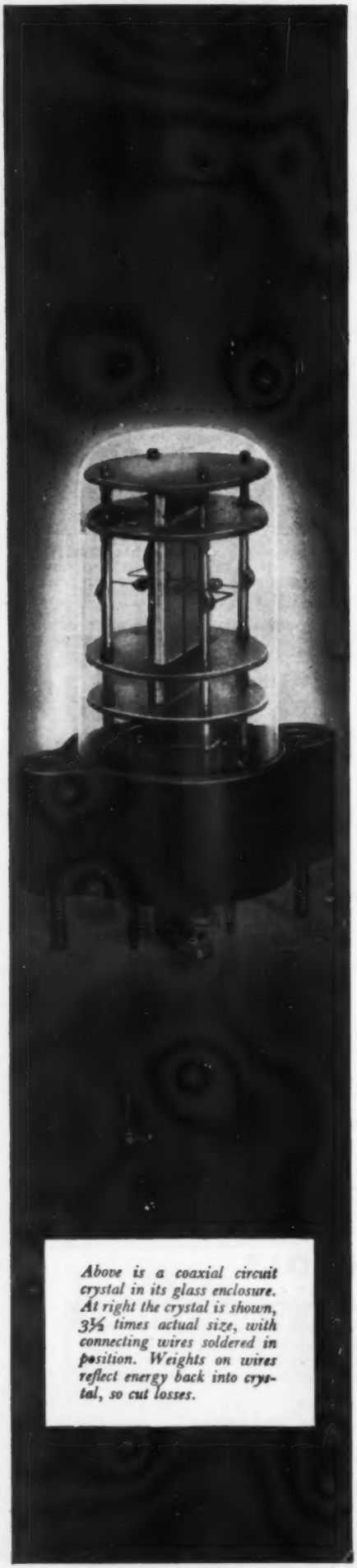
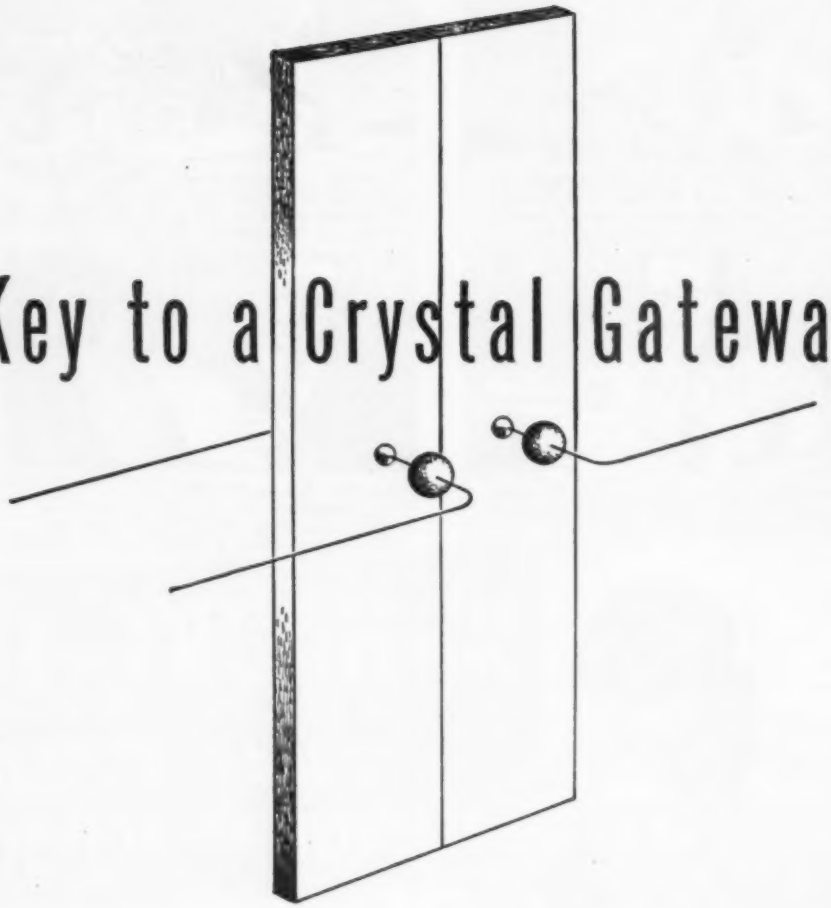


Above is a coaxial circuit crystal in its glass enclosure. At right the crystal is shown, 3½ times actual size, with connecting wires soldered in position. Weights on wires reflect energy back into crystal, so cut losses.

Key to a Crystal Gateway



How would you solder a wire to a crystal? This must be done for most of those wafer-thin plates of quartz used in electrical circuits. They play a big part in the myriad-channel telephone system that utilizes coaxial cables.

This is how Bell Laboratories scientists solved the problem: A spot of paste containing silver is deposited on the crystal and bonded to it by oven heat. The crystal is then vapor-plated with a thin layer of silver. Then a fine wire is soldered to the spot by a concentrated blast of hot air. The result is a rugged electrical connection to the surface of the crystal which does not interfere with its vibrations.

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(Note: KOLORDISK BC HI-KAPS *are not recommended for resonant or tuning applications.)*

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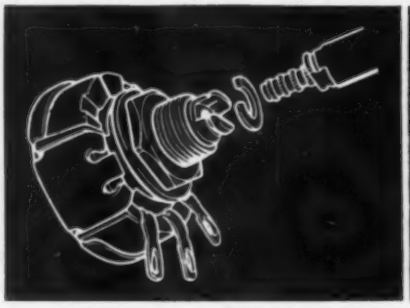

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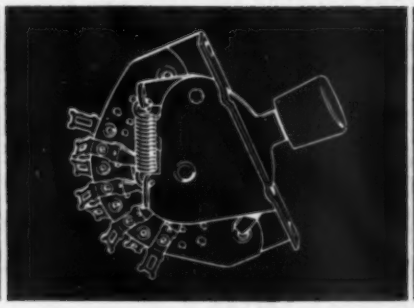
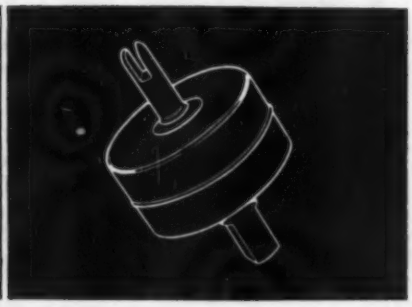


SWITCHES

ROTARY for band change, meter, intercom circuits; made in ceramic and phenolic models. ROTARY SPRING RETURN for meter selection, intercom, phono-radio applications. MEDIUM DUTY for band changing in low power exciter-transmitters and receivers. LEVER ACTION for for intercom, speaker, microphone and other applications.



CAPACITORS

TC HI-KAPS for correcting temperature drift in TV, FM, AM, VFO circuits. BC HI-KAPS for by-pass and coupling applications in non-resonant, TV, AM, FM, AF, HF, VHF and UHF circuits. HI-VO-KAPS for TV power supplies. CERAMIC TRIMMERS for padder application in TV, AM, FM and HF circuits.

Centralab

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Division of **GLOBE-UNION INC., Milwaukee**

Within the INDUSTRY

RUFUS SCHAGER, a tool and die maker for *Sylvania Electric Products, Inc.,* was awarded $3950.00 for his suggestion for improving small metal parts. This is the highest award yet made by the Emporium, Pa., radio tube plant, and according to J. C. Farley, general manager, the idea received the top award because it has materially reduced shrinkage in radio tube production, increased production, and shortened the time required for a basic small parts operation.

The suggestion system was started in *Sylvania* plants seven and a half years ago, and since then, $18,594.00 has been paid for 809 ideas adopted.

* * *

HAROLD HEINDEL, associated with the *Andrea Radio Corporation* for twenty-five years, has been appointed secretary of the organization.

Mr. Heindel, an outstanding figure in the development of both radio and television, was responsible for designing the first radio speakers for the *Andrea* radio sets.

Along with his new duties, Mr. Heindel will continue in his capacity of Chief Engineer for the corporation, manufacturers of the *Andrea* "sharp focus" television sets.

* * *

WARD LEONARD ELECTRIC CO., Mount Vernon, New York, announces that its general office has been moved from the factory building at 31 South St. to a new office building at 115 S. MacQuesten Parkway, Mount Vernon, New York. **TINNERMAN PRODUCTS INC.** has moved its New York district office from 620 Lexington Ave., New York City, to new and larger quarters at 75 Roseville Ave., Newark, New Jersey.

* * *

MICHAEL L. KAPLAN is president-elect of the newly formed Television Manufacturers' Association, which is now officially incorporated under the laws of New York State.

Mr. Kaplan, who is also president of *Sightmaster Corporation,* made the announcement after the initial meeting of the group. Ways and means by which the TV industry's service to the public can be bettered and increased are among the aims of TMA. The members realize that success in business is dependent on the public, and therefore the association will aim to reform and prevent abuses which have hurt the industry, such as the misuse of technical information employed to confuse and mislead the public.

Since the initial meeting of TMA, there has been steady activity in the group, and Mr. Kaplan has been contacted by many firms who report that an organization such as this has long been needed in the industry, and who have expressed their full support.

* * *

EVERETT GILBERT has been promoted to the position of vice-president of engineering at the *Radio Frequency Laboratories, Inc.,* Boonton, N. J.

Mr. Gilbert, a graduate of the University of Colorado, although only 28 years old, has been special projects engineer since 1945 and was previously with *General Electric Company* as a member of a development group on the Manhattan Project. His accomplishments at *RFL* include development of a new electronic metal detector for industrial processing lines. He is a member of several engineering societies, including IRE.

* * *

EDWIN J. SHERWOOD has been appointed television promotional manager of *Admiral Corporation;* his principal duty will be to conduct, in cooperation with *Admiral* regional sales managers, television sales training programs for distributors in the present thirty-five TV markets, as well as for those distributors in markets where television is just around the corner. **DR. ROBERT L. JOHNSON,** president of Temple University, is a newly elected director of the *Avco Manufacturing Corporation.* **DR. JOHNSON** is a trustee of the International YMCA, and is affiliated with many educational and charitable organizations; he was recently named chairman of the Citizens' Committee to press for favorable action on the proposals of the Hoover Commission. **R. T. PENNOYER** will succeed the late R. O. Poag as manager of the *General Electric Company's* Buffalo tube works. He will be concerned mainly with the manufacture of television picture tubes, the chief product of the company's Buffalo plant. *Lear, Incorporated,* at the annual meeting of stockholders, elected three new directors: **HAROLD R. BOYER** of Detroit, Mich., **COL. THOMAS N. BELSHE,** *Lear's* representative at Washington, D. C.; and **O. C. HALL** of Grand Rapids, Mich. The recent appointment of **JAMES J. SUTHERLAND** as general manager of the Electronics Division of *Sylvania Electric Products, Inc.,* was announced by H. Ward Zimmer, vice-president. To meet the demands of increased pro-

PRACTICAL HOME-STUDY RADIO COURSE

"FINEST, UP-TO-DATE," TRAINING COURSE USED IN MANY SCHOOLS

"The radio training *course* is the finest up-to-date easy to understand course. . . . This course outlines practical work. We are using this course in our Topeka High School. It is wonderful." *Henry Ward, Jr.*, 622 Filmore St., Topeka, Kans.

WORTH MUCH MORE

"You should get more money for your Course. The first week I studied it, I made $10.00 repairing sets. I built my own test outfit from details given in this course. I have repaired 100 radios to date. . . ."
Signed: *Robert C. Hammel*, 120 W. 13th, Davenport, Iowa.

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"I am very satisfied with the course. When I was at the twelfth lesson I started repairing radios. It took me two months to master your course." From a letter written by *Roger Langlois*, 1679 Poupart St., Montreal, Canada.

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"Your course is modern and up-to-date. There is not one page in the whole course which anyone can afford to miss. Your course started me on the road to a well paid job and has repaid me many times." *Charles Alspach*, 433 Elm St., Reading, Pa.

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Here is your chance to take advantage of the most sensational offer in radio education. In this large course-manual of lessons you have all the topics covered by the best $150.00 radio correspondence course. Learn important fundamentals. Speed-up radio servicing. Includes hundreds of circuits, thousands of repair hints, pages of practical short-cuts.

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This practical home-study **course** will show you how to repair all types of sets faster and better, tell you how to open your own shop and run the business. The lessons are well illustrated, interesting to read, easy to understand and apply. No special previous knowledge is needed. The early lessons explain important principles. Other lessons cover test equipment, trouble-shooting, circuit tracing, television, and every important topic of radio.

SERVICING METHODS SIMPLIFIED

Learn new speed-tricks for radio fault-finding, case histories, servicing short-cuts, extra profit ideas. Included are many large lessons on the use of regular test equipment, explanation of signal tracing, oscilloscope, transmitters, P.A., television, recorders. Let this information save for you enough time on a single job to pay the full price of $2.50 for the complete **course** of 22 money-making lessons.

SOME OF THE TOPICS

Circuits, Auto Sets, P.A., Tube Characteristics, A.C., Fidelity, Using Charts, Amplifiers, Tracking, I.F., Phase, T-V, Reactance, Impedance, Modulation, A.V.C., Photo-cell, Review Questions, Crystals, Test Equipment, Meters, Analyzers, Tube Testers, Signal Tracing, Oscilloscope, Ohmmeters, Accuracy, Graphs, and hundreds of other radio and T-V topics.

EASY TO UNDERSTAND AND APPLY

The practical lessons making up this course-book are easy to follow and apply to actual radio jobs. Hundreds of radio facts that puzzled you will be quickly cleared up. You will find yourself doing radio repairs in minutes instead of hours—quickly finding the faults or making needed adjustments. Every new radio development of importance and thousands of time-saving radio facts are packed into this complete course-manual.

SATISFACTION GUARANTEED

Use the "no-risk" coupon at the bottom of this page to order the complete **Course** for a 10-day examination. Look over the lessons, read a few sections, apply some of the hints to a few service jobs. Only then decide to keep the lessons at the bargain price of $2.50 (full price), or return the material and receive a cash refund. Like other **Supreme Publications** listed below, this **Course** is available to you without risk, on a 10-day, satisfaction guaranteed, trial basis.

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MOST-OFTEN-NEEDED RADIO DIAGRAMS
Each manual has between 192 and 208 pages of diagrams and service hints; large size, 8½x11". Price, each..... **$2.**

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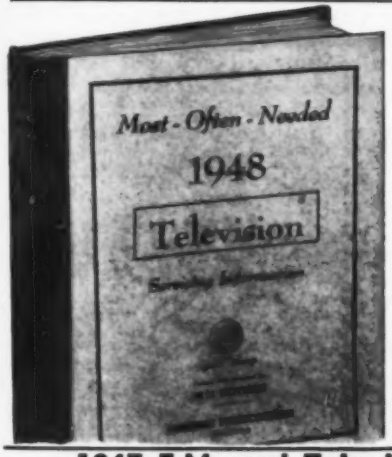
You can speed-up and simplify radio repairs with **Supreme Publications** manuals. Service all radios faster, better, easier, save time and money, use these **most-often-needed** diagram manuals to get ahead, earn more per hour. For the remarkable bargain price (only $2 for most volumes) you are assured of having in your shop and on the job, needed diagrams and other essential repair data on 4 out of 5 sets you will ever service. Every popular radio of all makes, from old-timers to new 1949 sets, including F.M. and Television, is covered. Clearly printed circuits, parts lists, alignment data, and helpful service hints are the facts you need to be an expert in radio servicing. Save hours each day, every day, begin to earn more by making repairs in minutes instead of hours. Let these manuals give you diagrams for 80% of all sets. There is no need to spend large sums for bulky, space-wasting manuals of other publishers, or to buy additional drawings every few weeks; be wise, use **SUPREME** Manuals to get the most in diagrams and service data for the smallest cost. Select manuals wanted and rush "no-risk" coupon.



1948 TELEVISION

New, giant volume of **1948 Television** factory data covers every popular make. Gives description of circuits, pages of test patterns, response curves, alignment facts, oscilloscope waveforms, voltage charts, service hints, many diagrams in the form of double-spread blueprints, test points, everything to bring you up to date and make you expert in T-V repairs. Large size: 8½x11", manual style binding, flexible covers, price only **$3**

1947 F.M. and Television Manual

Manual of instructions for trouble-shooting, repairing, and alignment of all popular 1947 F.M. and Television sets. Covers every popular make; includes F.M. tuners, AM-FM combinations, and all types of T-V receivers. This is the material you need to adjust and fix any modern F.M. and T-V set. Data on 192 large pages, 8½x11". Sturdy, manual style binding. Your price, only..... **$2**

SIMPLIFIED RADIO SERVICING

New, revolutionary different **comparison** technique permits you to do expert work on all radio sets. Most repairs can be made without test equipment or with only a volt-ohmmeter. Many simple, point-to-point, cross reference circuit suggestions locate faults instantly. Covers every radio set—new and old models. Over 1,000 service hints, 63 job-sheets, 26 large trouble-shooting blueprints. 114 tests you can make using a 5¢ resistor. Complete..... **$1.50**

Post-War Automatic RECORD CHANGERS

Service expertly all modern (1945-48) record changers. Includes every popular make. Just follow simplified factory instructions to make needed adjustments and repairs. Hundreds of photographs and exploded views. Large size: 8½x11 inches; 144 fact-filled pages. At your radio jobber or postpaid, special bargain price, only..... **$1.50**

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PRICED AT ONLY $2 EACH
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duction at *Workshop Associates, Inc.*, Newton Highlands, Mass., **FRANK O. STAVES** has been appointed to the position of plant superintendent, bringing to his new post many years of experience in the field of plant management.

* * *

FLOYD MAKSTEIN has been named television field engineer for *Emerson Radio and Phonograph Corporation* and will serve as adviser to *Emerson* distributors throughout the country on television servicing and installation procedures.

Mr. Makstein joined *Emerson Radio* in January, 1945, upon his release from the armed services. For several years he worked with the television engineering staff and then was assigned to the company's subsidiary, the *Emerson Television Service Corporation*, working on the development of the service organization.

In rejoining the national manufacturing organization, Mr. Makstein will introduce an educational program for technical personnel of both distributors and dealers.

* * *

EUGENE B. LUCAS, well known to the radio industry, has been appointed sales manager of *Walco, Inc.*, maker of *Walco* standard and micro-groove phonograph needles, Tele-Vue lens, and *Walco* Television Filters. **YOUNG & MYERS,** 539 Jewel Ave., Kirkwood 22, Mo., will be the sales representatives in Eastern Mo. and Southern Illinois for the line of resistors, controls, and resistance devices made by *Clarostat Mfg. Co., Inc.*, of Dover, New Hampshire. **ALBERT M. BAEHR** is the new sales representative in Ohio for *C. P. Clare & Co.*, Chicago relay manufacturer; his offices will be at 11621 Detroit Ave., Cleveland 2, Ohio. With the addition of the **NEAL BEAR CORPORATION** of Peninsula, Ohio, and **ED OSSMANN,** Rochester, New York, *Hermon Hosmer Scott, Inc.*, will attain virtually complete national sales representative coverage. They will serve jobber and industrial accounts throughout their respective territories. The appointment of **ROY BOSCOW** as general sales manager was announced recently by the *Magnavox Company.* Mr. Boscow brings to his *Magnavox* position much valuable experience acquired while serving in responsible capacities with various large corporations. *Motorola, Inc.*, Chicago has appointed **ELLIS L. REDDEN** as its director of advertising and sales promotion. Mr. Redden has acquired a good deal of background in his field, having served in that capacity with *Borg-Warner, McCann-Erickson,* and latterly, with the *Avco Manufacuring Corp.* **ROBERT C. HOFFMAN** has been transferred from industrial engineer to Chicago distributor

(*Continued on page* 148)

TV Offers YOU Good Pay, Security and Bright Future

CREI On-the-Job Training Can Give You the Technical Ability to Step Ahead of Competition and Get the Better Job You Want

GET IN and *get ahead* in Television! You can make your own opportunity if you start preparing *now*. No need to tell you how fast Television is expanding—or, of the great number of jobs that are being created. One of industry's leaders predicts: *1 Million Persons in TV within 4 Years!* He estimates 12 Million TV sets by 1953—40 Million by 1958.

If you are now in radio, and wish to get in Television, CREI offers the very training you need to go after—*and get*—a good TV job.

CREI can show you the way with convenient spare-time study at home that gives you the up-to-date technical background and understanding you *must* have for Television. CREI courses are designed to give you a thorough grounding in basic principles and take you step-by-step through the more advanced subjects of TV and its related fields. It must be remembered that all new electronic developments have their roots in past techniques. That's why your own radio experience is so important and worth while when coupled with modern CREI training. You will find CREI basic and helpful right from the start. You will learn about and understand such subjects as: Optics, Pulse Techniques, Deflection Circuits; RF, IF, AF and Video Amplifiers; FM; Receiving Antennas; Power Supplies; Cathode Ray, Iconoscope, Image Orthicon and Projection Tubes; UHF Techniques, Television Test Equipment, etc.

Don't wait another day. Television won't wait for you. In all our 22 years of association with professional radiomen we know that the man who acts promptly is the man who succeeds. The facts about CREI, our courses, and what we can do for you, are described in our 32-page booklet. It is well worth reading. Send for it now.

VETERANS: CREI TRAINING AVAILABLE UNDER G.I. BILL. FOR MOST VETERANS JULY 25, 1951, IS THE DEADLINE — *ACT NOW!*

If you have had professional or amateur radio experience and want to make more money, let us prove to you we have the training you need to qualify for a better radio job. To help us answer intelligently your inquiry—*please state briefly your background of experience, education and present position.*

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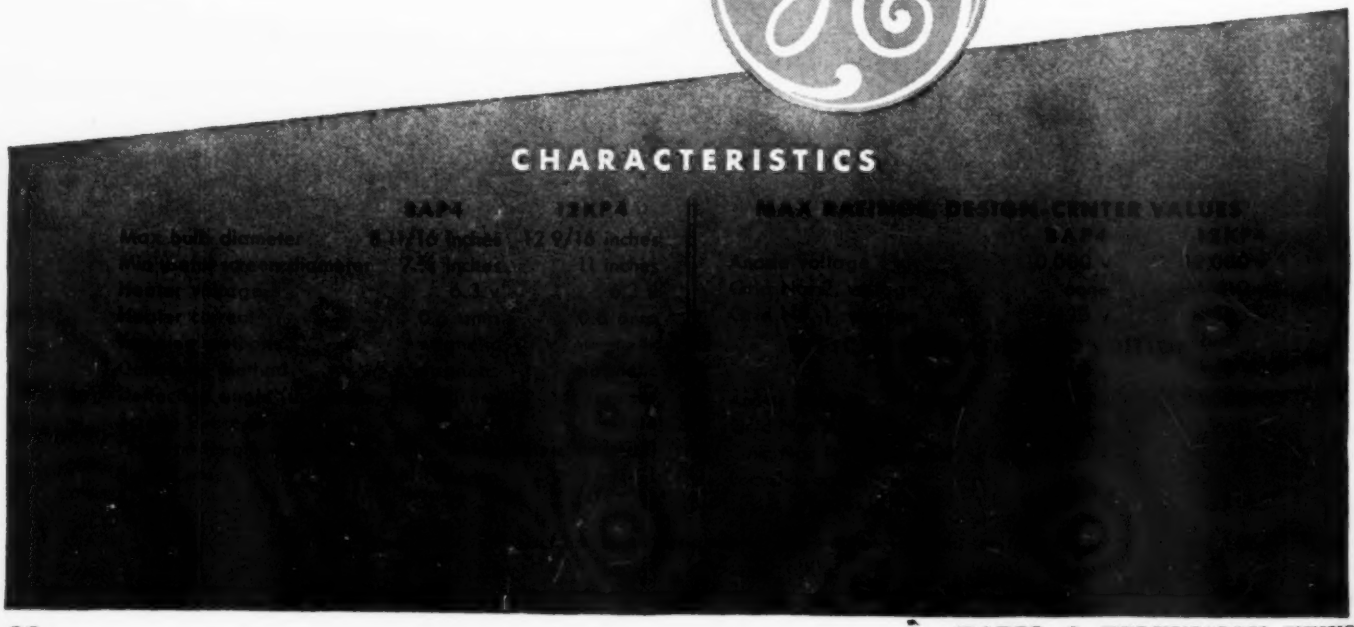
2 GREAT NEW TUBES FOR

WITH television racing ahead to new records in popularity—to ever higher figures in dollar volume—choice of picture tubes takes priority with designers and builders of receivers. The picture tube is the heart of the TV set. Cost, picture size, brightness—these must be carefully weighed in the light of the particular market at which a new receiver is aimed.

Good news to designers is G.E.'s introduction of the two tubes shown here. One—the 8½-inch type (8AP4)—dovetails with requirements of the low-priced receiver market where costs must be scrutinized down to the last penny. The 12½-inch aluminized tube (12KP4) matches the needs of that field of sale—also large—where picture size and quality come first.

Both tubes are G-E-designed to embody tomorrow's advanced engineering concepts. Both tubes are G-E-built to highest precision standards of quality!

GE



MASS TELEVISION MARKETS

TYPE 12KP4—A 12½-inch cathode-ray tube, all-glass construction. Aluminized screen. Offers *the brightest picture*—93 percent brighter (average) than a standard tube at 11,000 volts! Offers *a big picture*—95 square inches when the entire tube face is scanned; 75 sq. in. when standard raster of 3-by-4 aspect is employed. These areas are nearly half again as large as with the popular 10-inch type.... Here's the tube for TV-set manufacturers who put quality first, who wish to build consumer acceptance based on superior performance, on a larger, brighter, sharper picture.... *Here's the tube that's setting the pace in 1949 television!*

TYPE 8AP4—An 8½-inch cathode-ray tube with metal-cone envelope. Has plenty of picture area—47 square inches when the entire tube face is scanned; 36¾ sq. in. when standard raster of 3-by-4 aspect is used.... *Half the weight* of an all-glass tube, so ideal for small TV receivers that are lifted and moved about.... *Shortness of tube* (14½ inches) saves valuable space for the cabinet designer ... *Requires a simpler, less costly circuit,* because the 8AP4's triode construction does away with need for a Grid-No.-2 voltage supply.... *Low in price,* up-to-the-minute in design—a combination that's putting this tube in first place with builders of small TV sets.

Size; responsibility; wide facilities for research, for manufacture—these identify a top source of supply for any manufactured article. Your source for picture tubes need be no exception. General Electric is actively engaged in every phase of television—has pioneered many important TV developments—brings to each tube type the knowledge gained from designing and building

of picture tubes to the receiver you may be designing. Your phone-call, wire, or letter will bring immediate, helpful response. General Electric's distributor-dealer facilities for replacing picture tubes in owners' sets are nationwide; your sales outlets and customers can depend on

MODEL
666-R
$24.50
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A *New* TRIPLETT POCKET-SIZE VOLT-OHM-MIL-AMMETER

with self-contained Resistance Ranges to 3 Megohms

Note the special features of this New handy-size tester

(1) RESISTANCE RANGES from 0-3000 Ohms (.5 Ohm low reading) to 3 Megohms, self-contained. Also A.C.-D.C. Volts to 5000, 10 ranges; and 3 Direct Current ranges.

(2) ENCLOSED SELECTOR SWITCH, molded construction. Keeps dirt out, and retains contact alignment permanently.

(3) UNIT CONSTRUCTION - Resistors, shunts, rectifier, batteries are housed in a molded base integral with the switch. Direct connections without cabling. No chance for shorts.

(4) RESISTORS are precision film or wire-wound types, each in its own compartment.

(5) BATTERIES EASILY REPLACED - Positive grip coil spring assures permanent contact. Makes replacement of batteries a simple procedure.

(6) STREAMLINED STYLING. Handsomely designed, pocket-size case. Only two controls, both flush with panel.

For Detailed Information
See your Radio Parts Distributor or write . . .

RANGES:

D.C. VOLTS: 0-10-50-250-1000-5000, at 1000 Ohms/Volt

A.C. VOLTS: 0-10-50-250-1000-5000, at 1000 Ohms/Volt

D.C. MILLIAMPERES: 0-10-100, at 250 Millivolts

D.C. AMPERES: 0-1, at 250 Millivolts

OHMS: 0-3000-300,000
. . . . . (20-2000 at center scale)

MEGOHMS: 0-3
. . . . . (20,000 Ohms center scale)

(Compensated Ohmmeter circuit for greatest accuracy over wide battery voltage variations.)

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Precision first...to Last

TRIPLETT

Radar Training in the Air Force

By
MAJOR CHAS. E. SPITZ, W7JHS
Radar Dept., Keesler Air Force Base, Miss.

Complete radar training—from basic principles to actual working experience—is covered at the Keesler Air Force Base in Biloxi.

Student adjusting a feedline on an aircraft warning radar.

THE Mississippi Gulf Coast, long famous for its shrimp, "place of worship" for the followers of Izaak Walton, and general vacation land for people who like to bask in its sunny breezes, is the site of one of the Air Force's large technical schools. Keesler Air Force Base, one of the finest of the Air Force Training Command Installations, is also the home of Radar Training.

One of the bright spots of the ARRL Delta Division Convention, held at Biloxi, Mississippi, on September 19 to 21, was the tour of the Radar Department with its whirling antennas, crackling sparks, and flashing oscilloscopes.

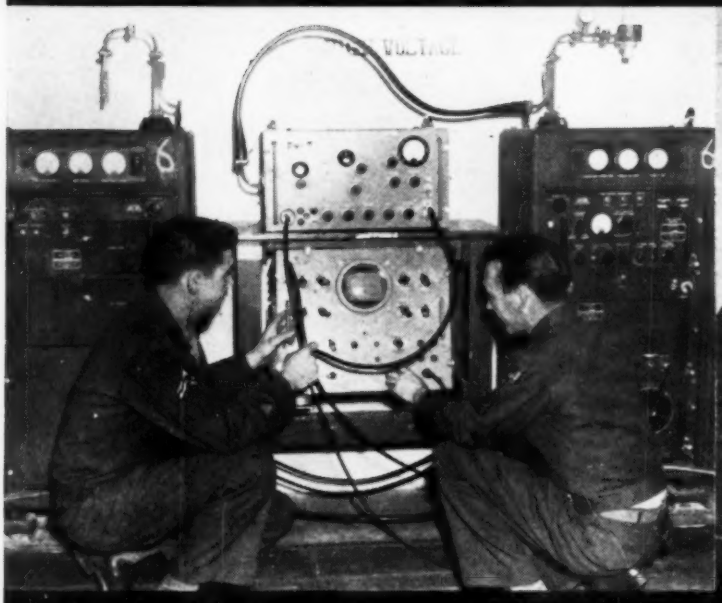
Radar, of course, is no longer one of the dark secrets of the past and much has been published on the subject; however, radar does exemplify some phases of radio at its peak efficiency, and every radioman who has had radar training has found his radio knowledge vastly strengthened. Radar antennas are of extremely high gain (and rotary, of course, as in the best amateur technique), receivers have such high gain and so low a signal-to-noise ratio that even some of the tubes used were bound to be adopted by the radio fraternity, where they now grace converters and pre-selectors in ham shacks throughout the country as the "hot" 6AK5 and 6J6, and QRM-less frequencies so high as to be barely tapped by communications people. It might easily be said that the commonplace in radar today is a view of the future in communications.

Radar training starts with fundamentals, 'way back at the beginning, both for men who can't hook up a doorbell and "oldtimers" alike. For the latter, it is a highly desirable refresher about many things long since forgotten, or skipped. For the beginner, it represents an introduction into the mysteries of electricity and an electronics career in the bud. The pace is fast, with six solid hours a day packed chock full of theory and lab; the general theme is to learn by doing, but you must understand what you do.

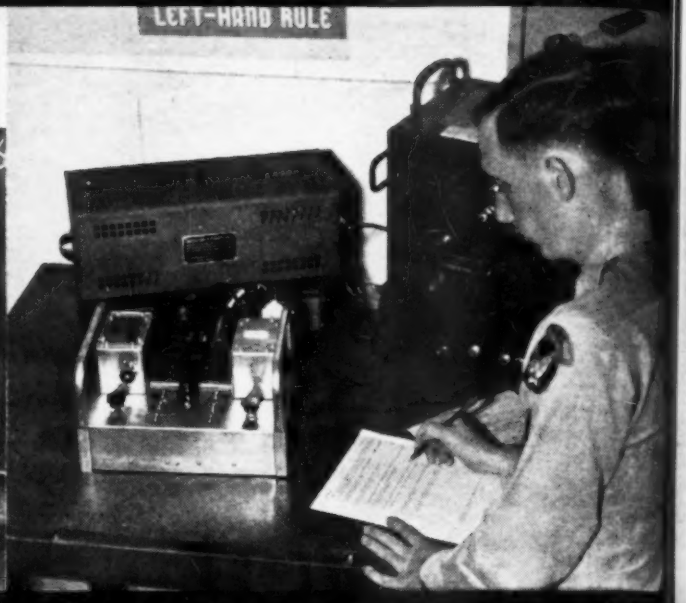
The course for a general airborne or ground radar mechanic is 42 weeks. Various specialist courses take different periods of time, depending on the scope and complexity of the work. The study of d.c. with the necessary accompanying mathematics starts the ball rolling. If you can assimilate the material contained in a text such as Cooke's "Mathematics for Electricians and Radiomen," you shouldn't have much difficulty. The student studies electrostatics, electrodynamics, and the circuit analysis of multiple generator and network circuits, magnetic induction, motors, generators and elec-

Radar training starts with fundamentals.

It includes six solid hours of theory.



Complete laboratory training is included.



Students perform experiments on circuits studied.

What makes the mutivibrator tick?

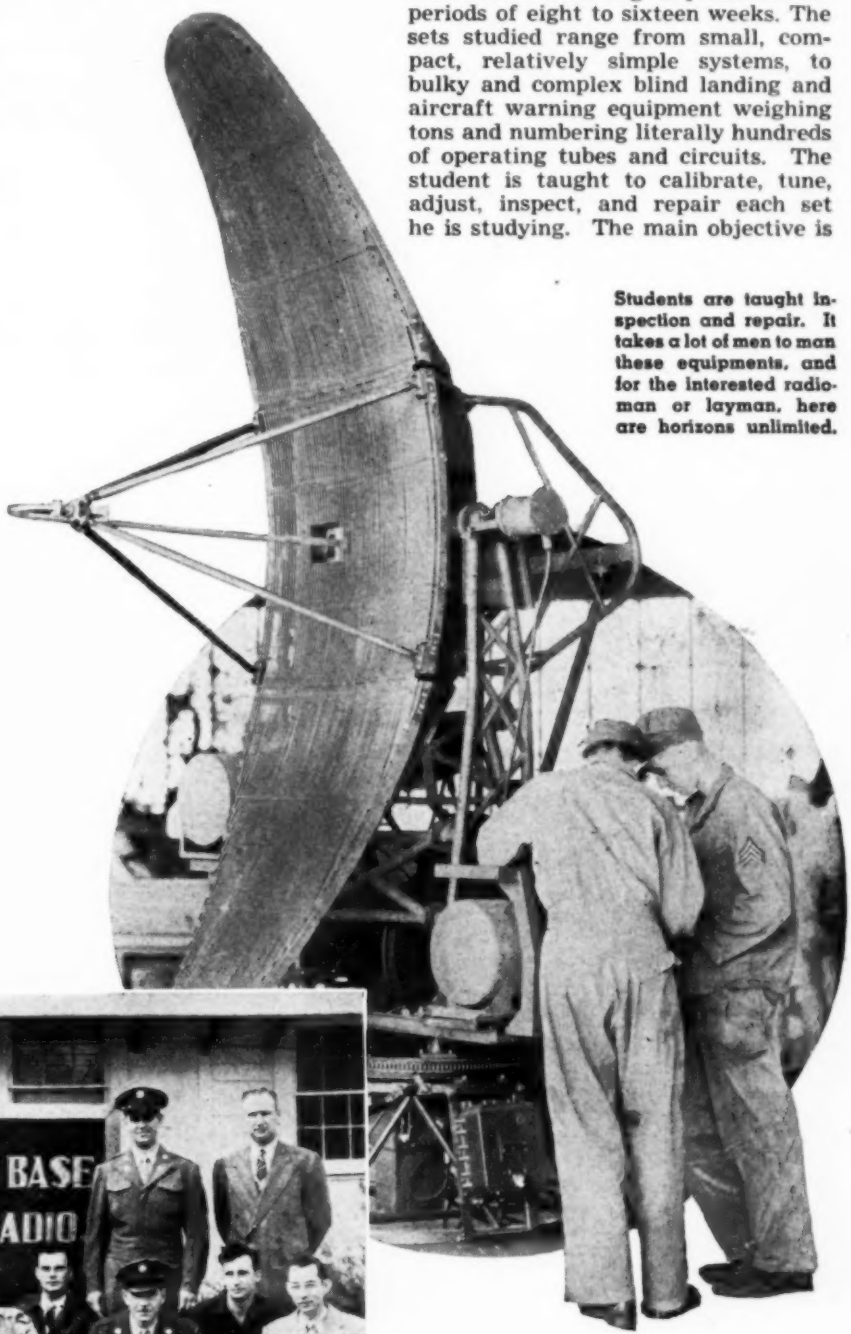
Students perform projects in Servo mechanisms.

trical measuring instruments which in turn are mastered before continuing to alternating current and its behavior in all types of reactive circuits. Intensive lab work is done where the student works projects in alternating current circuit analysis, resonance, and transformers. Particular emphasis is placed on vector analysis of alternating current networks and factors affecting magnitude and phase of circuit currents.

It gets even more interesting as you go along, for at this point electronics begins. Electronic emission, vacuum tube construction, characteristics of gas and cathode-ray tubes are studied concurrently with all types of rectifier power supplies and regulators. Enough equipment is provided so that each student performs experiments on each circuit studied, working independently of his classmates during the laboratory sessions. Amplifiers and oscillators come in for their share of scrutiny as do transients and nonsinusoidal alternating currents. Limiters, clampers, and sweep generators, common terms to the television people, are also subjects for study. One of the more interesting student experiments in this phase is the determination of the effect of coupling, staggered tuning, and loading of i.f. amplifiers. Laboratory exercises include tracing one- and two-stage amplifier and oscillator circuits and determining the effect of variable factors on gain, bandpass, frequency stability, etc. Using Thévinin's theorem, amplifiers are studied quantitatively by breaking down their complicated mass to equivalent circuits, which makes for ease of understanding and learning.

By now the student feels as though he has mastered a good deal, and he surely has. An oscilloscope is constructed by each student, and he completes this phase of training with further oscilloscope analysis, servo mechanisms and electronic timers. In the conclusion of electronic fundamentals, the principles of AM and FM modulation are studied, together with generation, transmission and propagation of microwave energy, impedance matching, how to convey the energy to the antenna by means of various transmission lines, and how to radiate it by various forms of antennas in order to produce desired directive patterns.

Six months of intensive work have gone into the making of our future radar man in order to ground him well in basic concepts, and both he and the Air Force have reason to be proud of his accomplishments so far. In order to apply this knowledge, whole sets and systems are studied and operated, and trouble shooting is practiced for periods of eight to sixteen weeks. The sets studied range from small, compact, relatively simple systems, to bulky and complex blind landing and aircraft warning equipment weighing tons and numbering literally hundreds of operating tubes and circuits. The student is taught to calibrate, tune, adjust, inspect, and repair each set he is studying. The main objective is



Students are taught inspection and repair. It takes a lot of men to man these equipments, and for the interested radioman or layman, here are horizons unlimited.

Typical club meeting of the Keesler Air Force base amateur radio club. Front row (left to right): 1st Lt. Paul W. Ridenour; Major Charles E. Spitz, W7JHS; 1st Lt. James S. Mays, W5PDS; S/Sgt. Lawrence K. Hulett; S/Sgt. Gilbert Becklin; Capt. James B. Sanders, W5LKI; T/Sgt. Marion T. Atkins; Sgt. Robert J. Townsend, Jr.; Mr. Ancil Z. Arseneau, W50PR. Rear row (left to right): Capt. B. E. Tillotson, W5PDW; 2nd Lt. Arvid E. Hamer, W4KJI; 1st Lt. N. B. Ostrye, W5PDV; WOJG, R. A. Champagne, W4KQW; Lt. Col. Francis R. Delaney.

Even small, compact, and simple systems are tried. The student is taught to tune, calibrate, and adjust.

Problems in trouble shooting.

to understand the principles of electronics underlying the various circuit combinations peculiar to each set, enabling it to do the job for which it was designed. Many different types of equipments are incorporated into the courses, and the student soon learns that specialized uses require specialized sets. Therefore, with a maximum of practical work, equipments taught are representative of those used for altimeters, bombardment, gun-laying, navigation, weather observation, search, height finding, blind landing, and air traffic control.

A typical section of the course deals with a simple radar system, such as a high-altitude altimeter, and by means of it, introduces the student to the kind of maintenance work he would be expected to do. This includes training on the sort of tools he will have to work with, such as test equipments, hand tools, and technical manuals. He also learns the basic circuits necessarily incorporated into a simple functional radar. Stress is placed on how these circuits are oriented with respect to each other, and the specific way these circuits are used to enable them to do the job for which they are intended. Most radars consist basically of the units found in the first one studied. Typically, these are the power supply, synchronizer, transmitter, antenna system, receiver, indicator and control panel. The usual relationship of these units to each other is best shown by a simple block diagram such as the one in Fig. 1, with the indicator arrows radiating from each source.

Some equipments are similar to FM radio, but because of their use, for example, a typical low-altitude altimeter, they are treated as radar. The set studied has widespread popularity, and does its job of measuring height above the ground so efficiently, it is used in a great many types of aircraft and by most airlines. One typical radar studied may seem rather large for airborne equipment, being a little more than a quarter of a ton, and consisting of no less than nineteen units connected by seven miles of wire! Other courses deal with aircraft warning radar. These giants, delicate though they be, indicate the movement of aircraft, telling of speed, direction and height, and some are so large they even have their own telephone system.

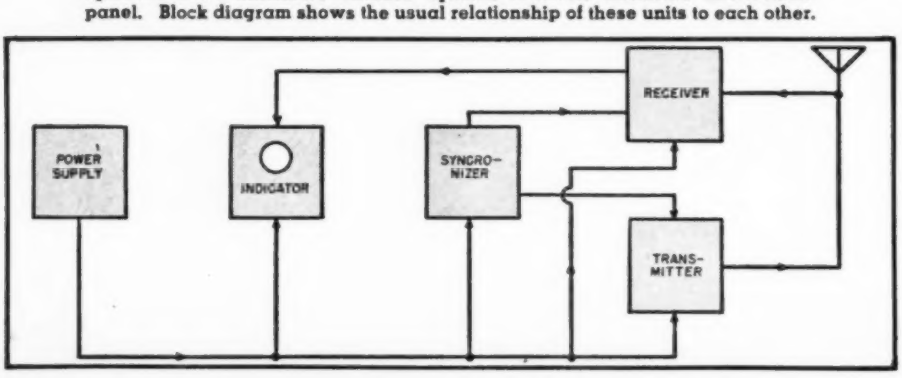
It takes a lot of men to handle these equipments, and for the interested radioman or layman, here are horizons unlimited; new circuits, techniques, and methods that stir the imagination. Here truly are careers awaiting men.

Recreation facilities are plentiful, and the average radio man or amateur is interested in the Keesler Air Force Base Radio Club, co-sponsor of the Delta Division 1948 ARRL Convention. Enthusiasm in the club mounts high. The clubhouse is a pretty white cottage, with two 600-watt transmitters, a four-element rotary on 10 meters, and fixed antennas on other bands. Many of the students and school faculty have their own rigs operating in barracks or quarters, and their calls are known throughout the world, wherever there are amateurs.

Many graduates leave to become well known DX stations, and it is not unusual to have D4, KG, and J hams arrive as students or instructors, both military and civilian. We like it here, know that you would, too, and hope some day to have the pleasure of welcoming you as one of us!

—30—

Fig. 1. Most radars consist basically of the following units: power supply, synchronizer, transmitter, antenna system, receiver, indicator, and control panel. Block diagram shows the usual relationship of these units to each other.



MINIATURE 4 TUBE TRANSCEIVER

Miniaturization in the extreme—yet this recently developed Signal Corps unit will find many practical uses.

George S. Colman, Coles Signal Lab. Eng., who designed experimental model transceiver, demonstrates operational technique.

EX-GI's who lugged around heavy communications equipment during the war will be interested to learn that the Signal Corps is working on a four-tube transceiver small enough to fit comfortably in a shirt pocket. The accompanying photos show an experimental model that weighs only eleven ounces *complete with batteries.*

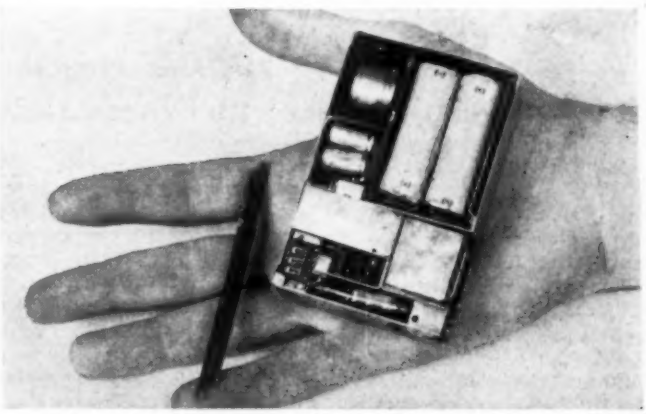
Intended only for voice operation, this midget-midget permits reliable conversation over distances of about 200 yards. Depending on terrain and other circumstances, much greater distances can be covered. The major part of the design work on this new set was done by George S. Colman, a civilian engineer employed by the Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

Except for a two-foot plug-in antenna which collapses to toothpick dimensions, there are no external wires, connections, or accessories. Both microphone and loudspeaker are built into the top of the case and are accessible to the mouth and the ear, respectively, when the lid is pushed up. With the lid closed, the device looks much more like a cigarette box than a radio set. Its actual size is 3½ by 2¼ by 1 inches.

Unit sub-assemblies with plug-in connections greatly simplify both initial construction and subsequent servicing. "Repair" is almost entirely a matter of pulling out one sub-assembly and sliding in a new one.

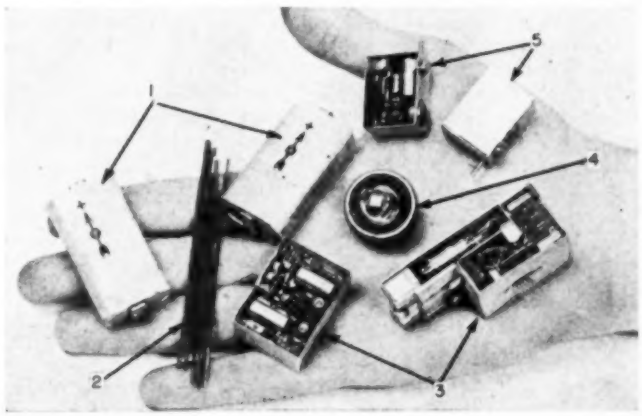
The filament battery is a single round cell of the mercury type. Two flat "B" batteries are used. All three batteries snap into place without wires.

Aside from demonstrating the model illustrated, and emphasizing that it is only experimental, the Signal Corps is not releasing any technical circuit data. However, from the dimensions of the r.f. coils that appear in the open in the plug-in tuning units, it is fairly safe to guess that operation on the medium-high frequencies, rather than the very-high frequencies, is intended. Tiny crystals about the size of a tack head are used to assure proper "netting" of several "stations." —30—



No idle space—the sub-assemblies nest together perfectly.

The watch-like parts used in the new Signal Corps 11-ounce transceiver do not even cover the palm of a hand. (1) "B" batteries. (2) Antenna, collapsed to six 4" pieces. (3) Main sub-assemblies, containing r.f. and a.f. components. (4) Mercury type battery. (5) Plug-in r.f. tuning units, used one at a time.



A Low-Cost Bandswitching V.F.O.

Fig. 1. Front view of the v.f.o. showing the direct reading full-vision dial.

By ROBERT LEWIS, W8MQU

A high-stability v.f.o. featuring fundamental three-band output with either v.f.o. or crystal.

EVER since the variable frequency exciter unit became popular, hundreds of ideas have come out of the amateur ranks, and reams of material have been written on the subject. The chances of digging up something new that has not been thought of before appear to be rather remote. Therefore, no claims are made on that score regarding the unit described herein.

The specific purpose in mind when this v.f.o. was designed was to produce an exciter that could be used to drive an existing crystal oscillator stage which would operate on the fundamental frequency or harmonics. It was desired to make the unit cover all bands below 30 mc. with a single external multiplier stage. Bandswitching and compact construction were to be incorporated, combined with maximum possible stability, all at the lowest possible cost consistent with good workmanship.

There are many manufactured v.f.o.'s on the market today, and at reasonable cost, too. Therefore, this article is written for hams who like to build, as well as operate, their own equipment.

A look at the diagram will show that the oscillator resembles the Colpitts circuit. Literature in recent ham publications setting forth claims of high stability for this circuit prompted the writer to try it out. At first an oscillator circuit was built using a 7A4 triode. This circuit had a grounded plate, with output being taken from the cathode. However, it was desired to use the following stage as a doubler, and it was found that insufficient driving power was available from the 7A4. Therefore, a 7C5 was substituted for the 7A4, with output now being taken from the plate as in any electron-coupled circuit.

The second stage in this v.f.o. unit incorporates a single 7C5 tube as a doubler. It could be operated straight-through, but in view of the fact that the unit was to be operated with output on the 20-meter band, it was deemed advisable to operate the oscillator no higher than the 7 mc. band. With a plate voltage of about 275 on the 7C5 and a screen voltage of 150, sufficient power output can be obtained to drive a small beam-power tube as a straight amplifier or multiplier.

Oscillator screen and plate voltage is maintained at 150 by means of a voltage regulator tube. The high-voltage rectifier is a 5Y3GT, which was chosen because of its small physical size. The power supply uses regular receiving-type components and with the ratings as given, temperature rise within the cabinet is normal.

First plans were to use plug-in coils, but after some consideration it was concluded that coil switching could be conveniently used at a negligible increase in cost. Rather than utilize a tapped-coil arrangement, separate coils for each band were used, in conjunction with a ceramic selector switch. A two-gang condenser tunes the oscillator and doubler simultaneously. Prior to beginning construction, plans for the entire unit were drawn up on paper. All the coils were calculated on an inductance-capacity slide rule. However, as might well be expected, they all had to be more or less changed after testing began. In most instances, a few turns had to be removed from the coils. More time was spent in getting the tuning of the v.f.o. adjusted than in the actual construction.

Band No. 1 covers a frequency of 3450 to 4050 kc. The fundamental output frequency of band No. 2 is about 6900 to 7500 kc. By using an external tripler circuit, output in the 21 mc. band can be obtained. For 20-meter fundamental drive, band 3 covers 13,500 to 15,000 kc. Operating the following stage in the rig as a doubler results in 11- or 10-meter output. Thus all the lower-frequency amateur bands can be covered with three sets of coils and one external beam-power tube operating as buffer, doubler, or tripler.

A 7x8x10 inch steel cabinet was used to house the v.f.o., in conjunction with a 2x7x9 inch steel chassis. The cabinet and chassis were both refinished in smooth gray lacquer in preference to the original black crackle. The main objection to crackle finishes is the difficulty in keeping dust from

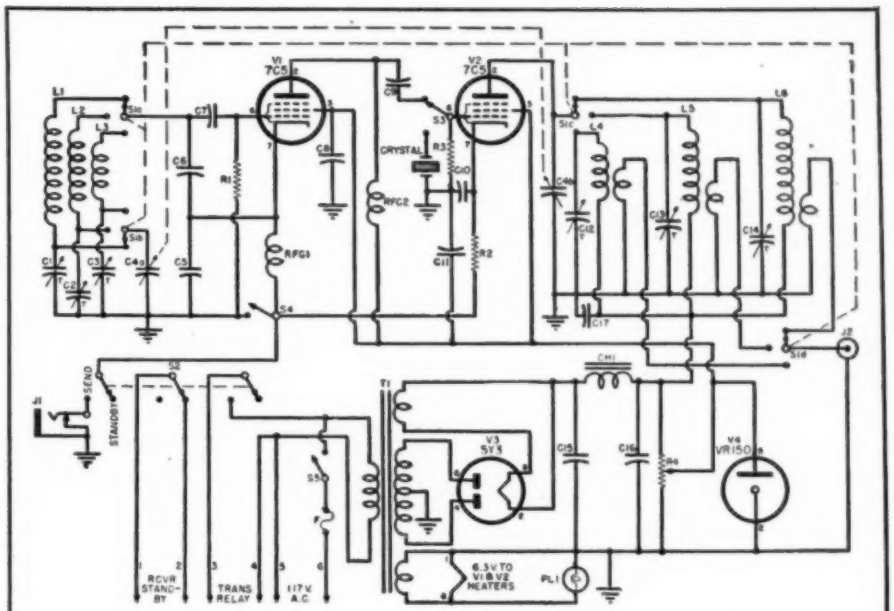
accumulating and becoming embedded in the paint. A word here might not be amiss regarding the painting of electro-zinc plated chassis. Some hams may already have known about this, but it was something new to the writer; this is the fact that lacquer does not adhere well to zinc-plated chassis, even when a good lacquer primer is used. In the case under consideration, the problem was solved by grinding off most of the zinc with a power sanding machine.

Observation of the photographs will show that all power supply components are mounted at the rear of the chassis. The coils are mounted vertically under the chassis with oscillator coils on the left and doubler coils on the right. Padding condensers are mounted alongside each respective coil. The band-change switch is mounted at the center of the chassis to facilitate wiring to both oscillator and doubler stages. First consideration regarding the tuning dial was to use one having a 0-100 scale in conjunction with calibration charts. However, after comparing the relative merits of that type, and the type having a calibrated scale, the *National* SCN dial got the nod. Controls along the lower edge of the front panel are: key jack, test switch, band switch, send-standby switch and power switch. Above the power switch is a "power-on" pilot light.

On the rear drop of the chassis is mounted a 6-terminal Jones strip to which are connected receiver cut-off circuit, transmitter relay circuit, and 117-volt supply line. Also mounted on the rear of the chassis are a fuse holder and output coaxial connector.

It will be noted that the v.f.o. incorporates a crystal socket and a single-pole, double-throw toggle switch S_3, providing crystal control at will. The 7C5 doubler stage then operates as the crystal oscillator, with output on the fundamental frequency of the crystal. When using crystal control, the tuning is set to the high-frequency end of the band in which the crystal is located.

(*Continued on page* 120)



R_1, R_5—100,000 ohm, 1 w. res.
R_2—390 ohm, 1 w. res.
R_3—20,000 ohm, 50 w. wirewound res.
C_1, C_2, C_3, C_{12}, C_{13}, C_{14}—50 μμfd. APC air trimmer cond.
C_{4a}, C_{4b}—25 μμfd. dual midget tuning cond. (Bud LC1661)
C_5, C_6—300 μμfd. silver mica cond.
C_7, C_9—100 μμfd. silver mica cond.
C_8, C_{10}, C_{11}, C_{17}—.002 μfd. mica cond.
C_{15}, C_{16}—10 μfd., 450 v. elec. cond.
S_{1a}, S_{1b}, S_{1c}, S_{1d}—4 pole, 3 pos., 2-gang ceramic band selector sw. (Centralab—2511)
S_2—3 pole, 2 pos. wafer sw.
S_3—S.p.d.t. toggle sw.
S_4—S.p.s.t. rotary sw.
S_5—S.p.s.t. toggle sw.
J_1—Closed circuit jack (key)
J_2—Coaxial connector
F—1-amp. 3AG fuse
PL_1—6.3 v. pilot lamp
RFC_1, RFC_2—2.5 mhy. r.f. choke
T_1—Power trans. 300-0-300 v. @ 70 ma., 6.3 v. @ 2.0 amps., 5 v. @ 2.0 amps.
T_2—Filter choke 15.0 hy. @ 70 ma.
Crystal—3.5, 7.0, or 14.0 mc. band as desired
V_1, V_2—7C5 tube
V_3—5Y3 tube
V_4—VR150 tube
L_1—80 meters—96 t. of No. 30 en. closewound on 1" form
L_2—40 meters—52 t. of No. 26 en. closewound on ¾" form
L_3—20 meters—24 t. of No. 22 en. closewound on ¾" form
L_4—80 meters—70 t. of No. 30 en. closewound on 1" form. Link 10 t. of No. 28 en. at cold end
L_5—40 meters—25 t. of No. 22 en. closewound on ¾" form. Link 5 t. of No. 22 en. at cold end
L_6—20 meters—15 t. of No. 22 en. spaced ¼" long on ¾" form. Link 3 turns of No. 22 en. at cold end
Both 80 meter coils wound on National XR2 forms. Forty and twenty meter coils wound on Amphenol No. 24, ¾" polystyrene forms.

Fig. 2. Schematic diagram of the completed v.f.o. Provision is made to control external circuits. A two-gang condenser tunes the oscillator and doubler simultaneously.

Fig. 3. Top view. S_1 is to the right of the tuning condenser.

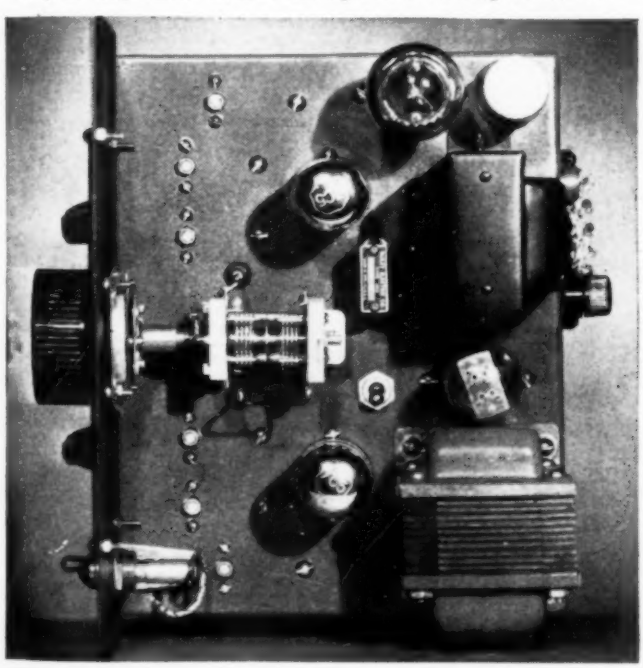
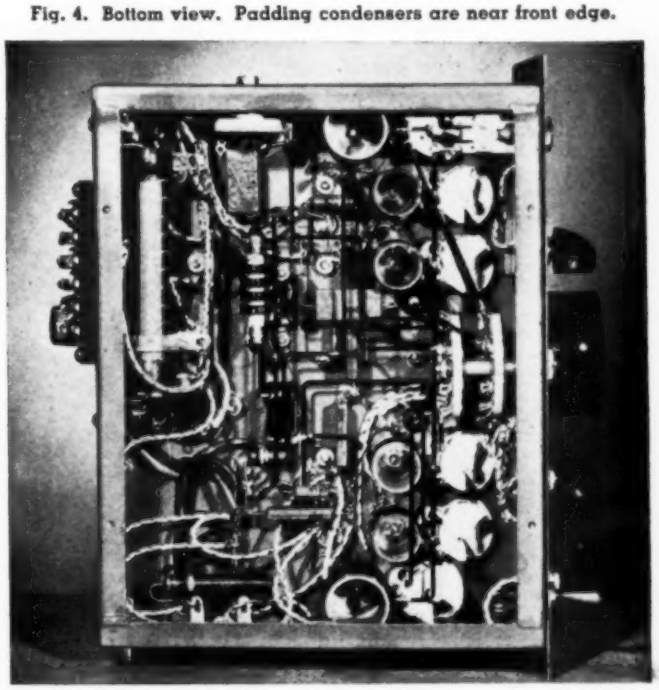


Fig. 4. Bottom view. Padding condensers are near front edge.



The *Television* ANTENNA

By
GARDINER G. GREENE
Pres., The Workshop Associates

Do not attempt your own TV installations without understanding the basic fundamentals involved in antenna-matching networks

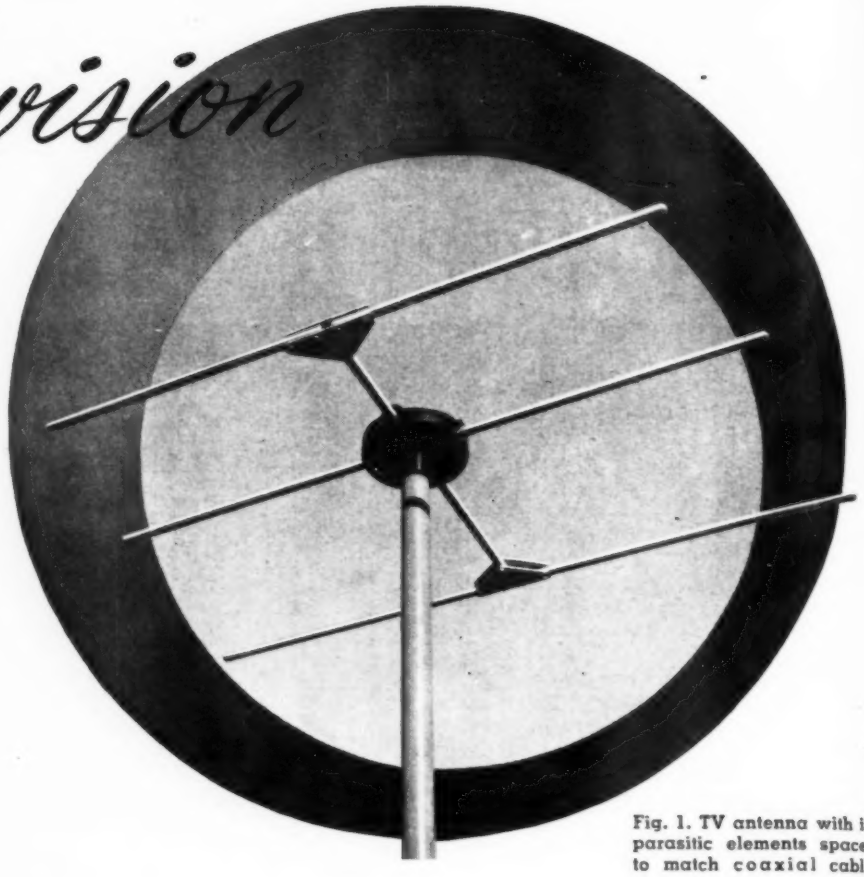


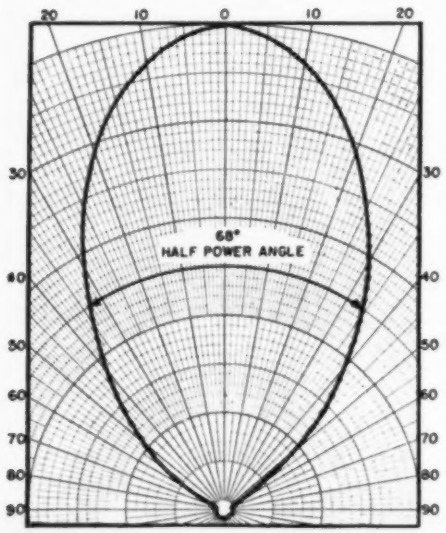
Fig. 1. TV antenna with its parasitic elements spaced to match coaxial cable.

TO GET the most out of the television installation, the installer must thoroughly understand the fundamentals involved in antenna-matching networks.

A television installation consists of a television antenna, transmission line, and television receiver. The maximum is realized from the installation of these three components when they are all of like impedance. Under the conditions of a perfect match at both ends of the transmission line, it is impossible for standing waves to develop on the transmission line. Standing waves cause a power loss and develop reflections which mar the television picture.

While it is true that there will be no standing waves on the line when the television receiver impedance matches the transmission line, it is very difficult for some manufacturers to make their receivers a fixed impedance over the wide TV spectrum from 54 to 216 megacycles. Therefore, should there be an appreciable mismatch at the receiver input, a perfectly-matched antenna and line will re-radiate whatever signal is reflected up the transmission line due to this receiver mis-match. In some systems employing long, low-loss lines, where there is an appreciable mis-match at both antenna and receiver, a large share of the reflected signal will not be re-radiated, but will return to the receiver with a total time delay sufficient to register ultimately as a "ghost" on the video display.

Fig. 2. Horizontal pattern in power for horizontally polarized three-element parasitic array. This pick-up pattern is for the antenna illustrated in Fig. 1 above.



If the line is not low-loss, it may attenuate the weaker reflected signal to the extent that it will not be perceived; a shorter line possessing a small transit time may not produce a "ghost," but will certainly create a fuzzy, indistinct image. Therefore, good engineering practice makes it mandatory to preserve impedance matches throughout the complete system.

As a transmission line, coaxial cable is preferred over balanced twin lead because of its higher signal-to-noise ratio characteristic, and with some types, such as RG-8/U and RG-11/U, it has lower loss. While coaxial cable is more expensive, it requires less time and care to install and it guarantees the stability and longevity of the installation. Many installers have disregarded coaxial cable, although they realize its value, because they were unable to connect it to the common type of television receiver which has a 300-ohm balanced input. This problem has been solved by the new, inexpensive impedance-matching transformer shown in Fig. 7. This transformer permits quick and easy connection to a transmission line and television receiver in the manner shown in Fig. 4. This unique transformer also solves two perplexing installation problems: (1) Increasing signal strength, and (2) Elimination of "leading ghosts" caused by direct pickup.

The transformer (Fig. 7) increases the signal level 2 to 1 in voltage. This voltage step-up in certain signal areas may be just the amount necessary to remove the "snow" from the TV picture. Another advantage in weak signal area installations is that the transformer permits the use of coaxial cable to match a 300-ohm receiver and thereby enables the installer to realize a greater signal-to-noise ratio by virtue of the shielded nature of the coaxial cable.

When coaxial cable is employed in an installation, a perfect match and maximum transfer of power from the antenna to the receiver can be accomplished by use of the TV antenna shown in Fig. 1. This beam antenna has its elements so spaced that its impedance at the TV channel to which it is adjusted approximates the impedance of the coaxial cable. The narrow beam pickup pattern shown in Fig. 2 raises the signal-to-noise ratio, since

It rejects spurious signals transmitted from devices located at the rear and side of the antenna's installed position, and increases the TV signals received by 5 db., relative to the response of the conventional one-half-wave dipole.

Fig. 5 shows further applications of this matched antenna in a stacked array which further increases the signal-to-noise ratio.

While the antennas shown in Figs. 1 and 5 cannot be used singly for 12-channel reception, it is possible to realize the benefits of efficiently matched antennas by circuiting several of these antennas to a TV receiver through a coaxial switch (Fig. 6) in the manner shown by Figs. 4 and 8. An antenna of the type shown in Fig. 1 offers a close match for coaxial cable on adjacent channels, e.g., an antenna cut for channel 3 will have a good match to the coaxial transmission line on channels 2 and 4. An antenna cut for channel 8 is a close match to the coaxial line on channels 7 and 9, etc. Therefore, a 6-channel high-gain installation could be made up with two antennas (Fig. 8).

Any one metropolitan area will not have active adjacent channels. A spectator living approximately midway between two fairly well-separated cities *may* be in a position to receive three consecutive channels as suggested in the foregoing. However, in congested areas served with TV signals of varying strength and from many directions, it is usually wiser to select, initially, the stronger channels carrying network programs of definite appeal to the spectator. Consequently, a few well chosen antennas can be used to render reliable and consistent signals in the manner of the multiple array configuration displayed in Fig. 3.

One of the most difficult TV installation problems to solve in strong signal areas is "leading or positive ghosts" which are created by TV signals, picked up by the unshielded conductors of 300-ohm "twin lead," and which arrive at the input terminals of the television receiver sooner than the TV signals from the antenna. The time delay involved makes the signal arriving from the antenna the second pattern on the screen. A "leading ghost" will mar the picture as badly as the common "lagging" or "negative ghost."

The "leading ghost" problem can be anticipated in strong signal areas by checking the television receiver to be installed without an antenna connected to its input terminals. If the TV pictures are strong and of high definition, a completely shielded installation is advised. To solve the "leading ghost" problem with a shielded installation, a coaxial line must be installed with a high-gain antenna. The high-gain antenna should favor the TV channel which indicates the strongest direct

(*Continued on page* 112)

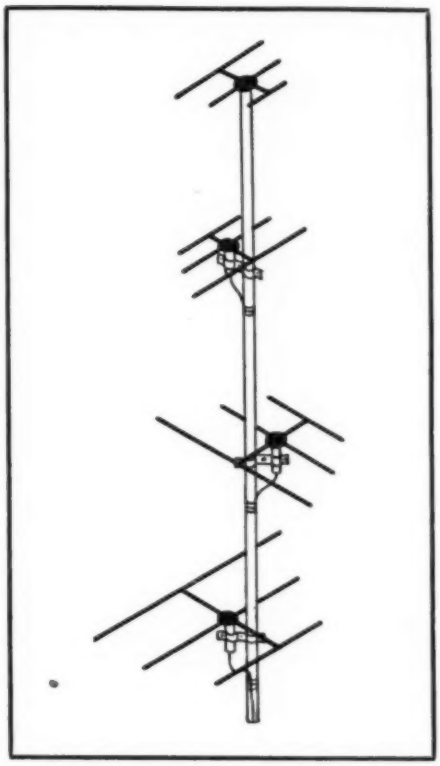


Fig. 3. A multiple-channel array which will permit reception on as many as ten channels.

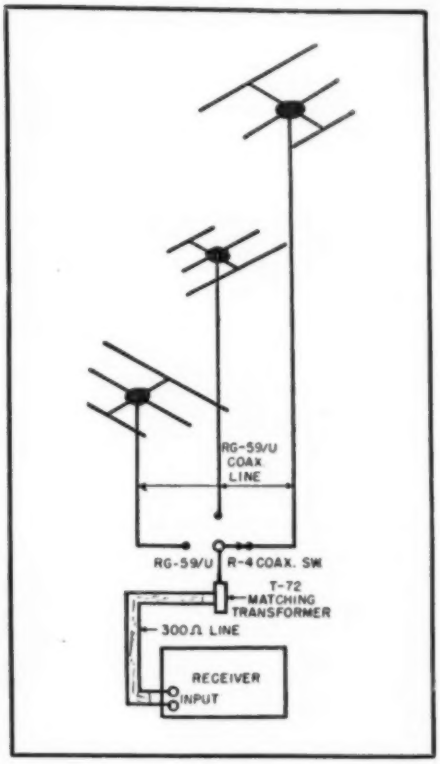


Fig. 4. Circuit of coaxial switch allowing one TV set to connect to three antenna lines.

Fig. 5. Six-element high-gain array. It has a higher signal-to-noise ratio than the antenna shown in Fig. 1.

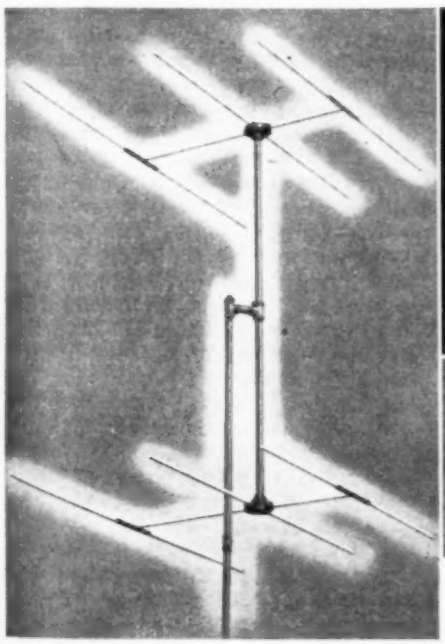


Fig. 6. A conventional coaxial switch that is used to connect a single TV receiver to any of four TV antennas.

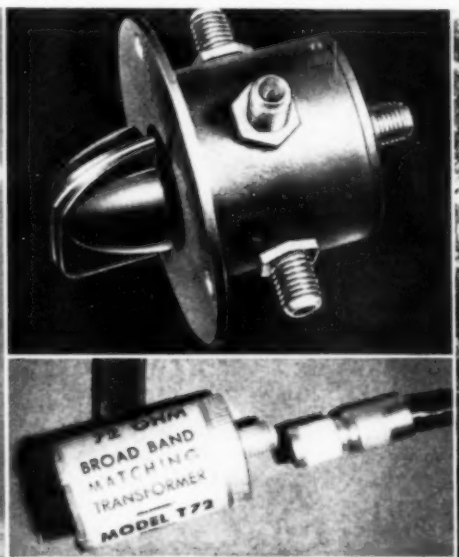
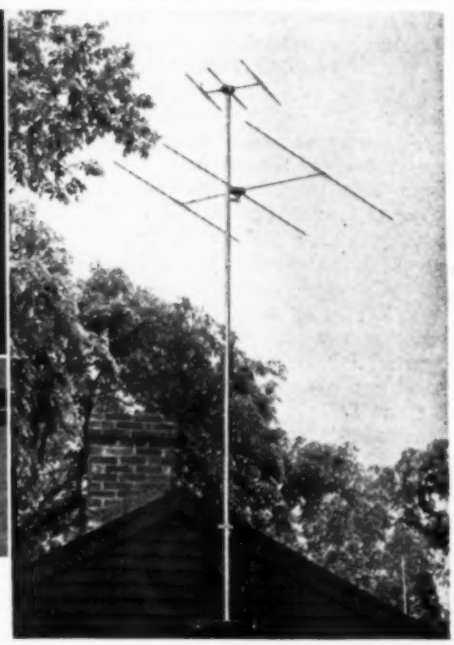


Fig. 7. Television matching transformer. Unit provides a voltage step-up ratio of 2:1 over the entire television spectrum.

Fig. 8. Typical high and low band television antennas mounted on a single mast for efficient four-channel operation.



Planning for Profit

By
FRED MERISH

A budget can start any month in the year—the sooner the radio and television dealer starts budgeting, the more actual profits he will show.

MANY are aware that 1949 has ushered in a buyer's market. In some fields the pipelines are full, inventories are at the highest level in history, and prices have softened. The day is over when the retailer can buy or sell with little or no thought to planning. From now on, he must plan his work and work his plan if he expects to earn maximum profits.

The way to plan successfully is to use a budget which is a forecast of sales, cost of sales, margin, overhead expense, and net profit for a forthcoming period, the estimated figures being checked against actual results with all substantial variances investigated.

A budget is set up in reverse. In other words, the dealer estimates his overhead expense first, then the desired net profit, arriving at the sales volume figure last. In setting up his overhead expense estimate, the dealer should use prior-period figures as the base, adjusting them in line with future plans.

Say that a review of experience figures for the prior twelve months shows that the ratios in relation to sales were as shown in Table 1.

These ratios are merely illustrative, and are not necessarily indicative of any dealer's experience figures.

When the ratios based upon sales have been determined by a review of experience figures, the next step is to budget, or estimate, the overhead outlay in dollars and cents. If this figure is set at $17,500, covering rent, light, office expense, insurance, etc., and if the overhead ratio to sales is customarily thirty-five per-cent, as shown on the foregoing table, divide 35 into $17,500 to get one per-cent, or $500; then multiply by 100 to get the budgeted sales volume (sales are always considered 100 per-cent), in this case $50,000.

With the sales figure budgeted, a dealer can easily fill in the remaining figures as shown in Table 2.

This is the basic formula for setting up a budget. If a dealer is not satisfied with a five per-cent net profit and wishes to increase the percentage, he must deduct the differential from the overhead, or cost of sales percentage, and then arrive at the dollars-and-cents estimate. No counsel can be given as to desirable ratios. This is entirely up to the dealer to decide, upon reviewing experience records and using his own judgment as to reasonable income, outgo, and net profit. Once the dealer fixes the budgetary figures, he should try to approximate them; hence, he must be realistic and not attempt the unattainable.

In arriving at the overhead outlay in dollars and cents, a dealer should consider, not only the outlay for the prior period, but any changes that future plans may make in the figure. If a dealer plans to increase his advertising outlay, or his selling expense, he must increase this estimate on the budget; if he plans to buy certain depreciable assets, he must include a depreciation charge for them. Every sensible businessman has a fairly good idea of what he intends to do along these lines over a coming period, and he adjusts prior-period figures on overhead expense accordingly.

The dealer will arrive at a sales volume figure based upon overhead expense, that can be used as a guide to profitable operation in a subsequent period; but this is a volume figure for the period as a whole, and, to be of value, it must be broken down to monthly totals. Sales volume varies during the year in accordance with seasonal business, selling efficiency, promotional activity, and consumer demand. Past experience figures, however, will be a good guide to these sales fluctuations.

For example, if January sales for a prior year, or a number of prior years, were 3.5 per-cent of total sales, the current budget is set up accordingly,

and subsequently for every month in the year. Let us suppose that prior figures showed the monthly ratios to sales listed in Table 3.

When budgeting for a subsequent period, a dealer should use the foregoing monthly ratios to set up his monthly quotas, the monthly percentage multiplied by the total sales volume, as estimated, to get the monthly sales figure in dollars and cents. To get the monthly figures for the cost of sales, overhead expense, and net profit, use the ratios shown on the foregoing tables. For example, the budgeted figures for January would be those shown in Table 4.

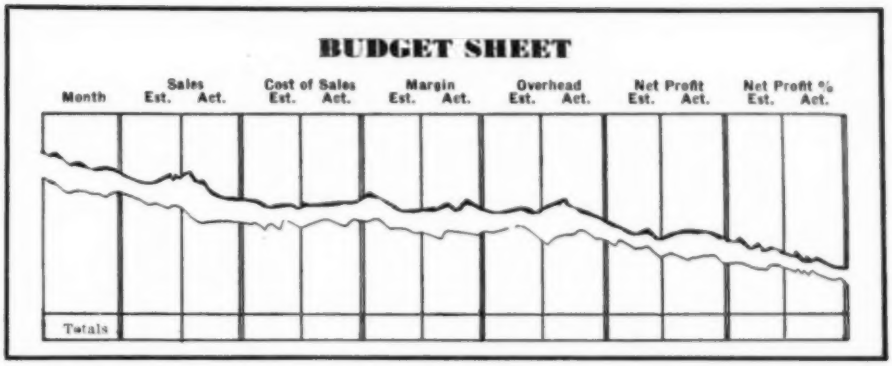
The dealer cannot expect to match estimated with actual results each month, or for the year as a whole, but a budget will give him some semblance of constructive control. The fact that in any month there may be a big difference between estimated figures and actual results does not negate the value of a budget as a check-sheet on operations. All budgets require a certain degree of flexibility, and the figures set at the beginning of a period may be changed if conditions warrant.

Budgeting may start any month and cover any period from a month to a year. If a business year ends in December, and a dealer starts budgeting in May, estimates may be forecast to December and budgeted from January to December thereafter, the budgets being kept in a looseleaf binder for comparative analysis so that the dealer can determine the accuracy of his estimates from period to period. If a dealer wants to budget quarterly or semi-annually, he forecasts each period as detailed here, getting experience figures from similar periods in the past, adjusting the figures, wherever necessary, to current conditions, and breaking down the total figures to monthly figures by referring to the customary results experienced in the months on his budget. At first, estimates may vary widely from actual results, but with the passing months, paying close attention to the figures, the dealer will find himself doing a better job of forecasting.

Some businessmen assume that because their operations are complex in certain phases, budgeting is impracticable, but this assumption does not square with the experiences of business men in general. Many concerns producing hundreds of different products budget operations with success.

One weakness in this field is lack of budgetary control. In our public accounting work, we find very few radio and television dealers who forecast operations. Such negligence from now on will prove more costly than in bygone years. Because of variables and uncertainties, operations will be hard to forecast, but this is no excuse for not budgeting, although some dealers do decry the efficacy of a budget for this reason. They contend that they do not know what the morrow will bring, so how can they budget for an extended futurity. Such businessmen do not understand the underlying purpose of a budget, which is to provide a jumping-off place from which to get perspective on future operations.

In checking our research work sheets covering prewar operations in the retail field, we find that ninety per-cent of the dealers using budgets made, or exceeded, anticipated profits, ten per-cent dropped below anticipated profits by an average of only eight per-cent, while none lost money. Of those not using budgets, only thirty per-cent made or exceeded anticipated net profit, forty-five per-cent did not make the net profit hoped for, the deficiency averaging twenty-two per-cent, and twenty-five per-cent lost money, even though they used a pricing formula that looked profitable on paper. It is only reasonable to conclude from these field studies that budgetary control in prewar years was essential to the attainment of maximum profits; and, certainly, if this business control gadget was needed in a more placid day, how much more imperative is its use in this postwar period, when business is "needled" by high costs, high taxes, inflation, and the threat of a buyer's market. —30—



When the figures for the budget have been compiled, they should be recorded on a budget sheet similar to the one shown above. The estimated sales should be checked against actual sales, likewise, the cost of sales, margin, overhead, and net profit, the results being entered in the proper column and month. Many dealers do not budget because they assume that it is an intricate process. The formula given in this article is easy to follow and can be applied to all businesses in this field, large or small.

Sales	100%
Cost of sales—purchased goods sold	60
Margin on sales	40%
Overhead expense	35
Net profit on sales	5%

Table 1.

Sales	$50,000—	100%
Cost of sales—purchased goods sold	30,000—	60
Margin on sales	$20,000—	40%
Overhead expense	17,500—	35
Net profit on sales	$ 2,500—	5%

Table 2.

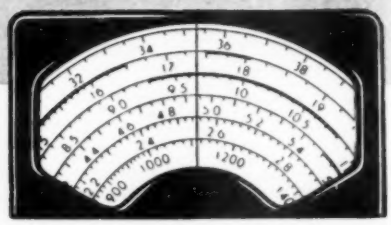
January	$ 1,750—	3.5%
February	1,600—	3.2
March	4,750—	9.5
April	5,000—	10.0
May	5,300—	10.6
June	4,600—	9.2
July	3,500—	7.0
August	2,500—	5.0
September	3,050—	6.1
October	5,700—	11.4
November	5,750—	11.5
December	6,500—	13.0
Totals	$50,000—	100.0%

Table 3.

Sales	$1,750.00—	100%
Cost of sales—purchased goods sold	1,050.00—	60
Margin on sales	$ 700.00—	40%
Overhead expense	612.50—	35
Net profit on sales	$ 87.50—	5%

Table 4.

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

IT IS a pleasure this month to dedicate the *ISW Department* to *"The International Goodwill Station,"* OTC, of the Belgian National Broadcasting Service, Leopoldville, Belgian Congo, and to its unique OTC Club. Thanks go to John J. Gaynor, California, for supplying us with this current information received by him from Leopoldville.

OTC is now operating on 9.767 (30.71 m.) with 50 kw. power and is scheduled as follows:

First transmission—1300-1400 Belgium calling the Netherlands and South Africa (Dutch); 1400-1415 (Dutch) and 1415-1430 (French) Belgium calling her countrymen in the world; 1430-1530 *(English)* Belgium calling Great Britain in the British Territories in Africa, with news 1432, news headlines 1527, and *"Amongst Friends"* (answering listeners' letters) 1445; 1530-1540 (French) Belgium calling her countrymen in France; 1540-1700 (French) Belgium calling France, Switzerland, and the French Union; 1700-1845 (French and Dutch) for the Belgian seamen and their French and Dutch friends; 1845-1900 closedown for change in transmitters to North and South America.

Second transmission—1900-2030 (French) Belgium calling Canada; 2030-2045 (French) Belgium calling countrymen in the world; 2045-2100 (Dutch); 2100-2300 *(English)* Belgium calling the United States and Canada, news 2102, news headlines 2255, and *"Amongst Friends"* (answering listeners' letters) 2115. On Wednesdays around 2115, DX items for SWL's and radio amateurs, including radio club information, are presented. On Friday of each alternate week, from last January 7, at 1445, there is a special *"Amongst Friends"* edition in Swedish, in answer to letters from Swedish listeners. A preview of the coming week's musical programs is broadcast each Sunday 1445 in the first transmission and 2115 in the second.

At present, verification *appears* to be by mimeographed letter, but *may* also send out QSL cards.

Data on the OTC Club as sent out by the station is:

"Listeners will be pleased to hear that the OTC Club has been formed, and that any time from now on applications for membership can be made. Membership tokens, in the form of a membership card and a small badge, will be forwarded to those of our friends who send us (1) one dollar (U.S.A. and the dollar zone), or, (2) five shillings (Europe and Africa), or, (3) five Swedish kronen (Scandinavian countries). This small charge is meant to defray printing and postage costs, but it is hoped that there will be a small surplus which will go to the benefit of the widows and orphans of members of the famous Underground Radio Resistance group, *'Samoyede,'* which did such fine work in Belgium during the war.

"*'Samoyede'* was conceived and created by a Belgian patriot, a reporter of the Belgian National Broadcasting Service, who was arrested by the Gestapo and interned in the infamous concentration camp at Breendonck. Having talked the idea over with other radiomen, he was lucky enough to escape to Great Britain and to work it out. Soon a man whose task it was to organize the underground radio net by getting in touch with former leading people of the *Belgian Radio*, was parachuted over Belgium, and it was the appearance of this parachutist that suggested the name of the underground group. As a matter of fact, his cheek bones were prominent as they are with the Northern Samoyede people.

"Membership in the OTC Club, therefore, brings closer contact between YOU and US and makes you an active promoter of friendship and international goodwill.

"In conclusion, we would like to point out that it is *not* essential to become a member of the club in order to get a reply to your letters; the club is the formal part of what is in reality an informal club group of OTC friends and listeners throughout the world. Nevertheless, we hope you will come forward to give active support to the OTC Club and its objectives. Our address is International Goodwill Station O.T.C., P.O. Box 505, Leopoldville, Belgian Congo."

Short-wave listener C. F. Bachman of Reading, Pennsylvania, believes that with patience and perseverance, real DX can be heard on comparatively simple equipment. Using a Hallicrafters S-20R receiver, and a ten-foot antenna, single-wire, running north and south, he has had verifications from Chungking, Radio SEAC, Radio Saigon, Radio Australia, All India Radio, and Honolulu, along with many others.

The Belgian Congo *(Congo Belge)* has an area of 902,082 square miles, and the 1942 population was 10,383,929. The Congo Free State had its origin in the vision of King Leopold II of Belgium, who, roused by Stanley's discoveries in Africa, realized the great economic possibilities in the development of the vast territory reached by the Congo. The International Association of the Congo, which he founded and largely financed, sent Stanley back (1879). He founded the first station, VIVI, in February 1880 and, in all, twenty-four before he returned in 1884. The territory was formally ceded to Belgium by treaty in 1908.

The average mean temperature is 80.6 F. but only 70 degrees in the high country constituting the rim of the Congo Basin, and the average rainfall is 43.27 inches. The native religion is gross fetichism, but there are 3,117 Catholic and 835 Protestant missionaries (1946) in the country. About one-quarter of the native population has been Christianized. Leopoldville, of course, is the capital city.

Vast, sunless, and well-nigh impenetrable tropical forests fill the upper reaches of the Congo River, covering about 25,000 square miles. Principal products of the Congo are palm-oil,

(*Continued on page* 103)

(Note: Unless otherwise indicated, all time is expressed in American EST: add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

Modern Televi...RS

By
MILTON S. KIVER

The Motorola Model VT-71. This receiver is only one of the many commercial types available designed around Intercarrier system.

Part 15. Additional notes on Intercarrier television systems, including advantages and disadvantages

THE *Motorola* Model VT-71 was one of the first Intercarrier receivers to appear commercially. The circuit contains several unusual features which merit special attention, aside from its operation as an Intercarrier television sound receiver. The set, Fig. 1, is provided with an 8-position station selector switch. Thus, although there are 12 television channels, the allocation is such that no more than 7 will normally be available in any one locality. This receiver can be aligned for the reception of any 8 stations.

The front-end section of the receiver consists of a 6AG5 r.f. amplifier, one-half of a 12AT7 as an r.f. oscillator and the other half as the mixer. The input terminals are so arranged as to provide input impedances of 75 ohms and 300 ohms. The 300 ohm terminals connect to each end of a center-tapped coil, whereas the 75 ohm terminals connect to one end and the coil center tap. The reason for this stems from the fact that the inductance of a coil varies as the square of the number of turns. Thus, a coil possessing twice as many turns as another coil has four times the inductance and, at the same frequency, four times the impedance. Since 300 is four times 75, the arrangement shown in Fig. 1 can be employed.

The incoming signals are transferred from the antenna terminals to the tuned grid circuit of the 6AG5 r.f. amplifier through an antenna coupling line. In the grid circuit, coil L_1 is for channel 2 or 3, L_2 is for channel 4, L_3 is for channel 5, and L_4 is for channel 6. In any one locality, L_1 would be tuned to the channel (either 2 or 3) which was occupied. Only one of these can be allocated in any one locality. These coils are selected by switch S_{1A} and transferred to switch S_{1B} where the coils for the upper channels are located. While any one of the channels from 2 to 6 are in use, the energy passes through the high band coils (L_5 to L_7) all of which are connected in series. For the high band (channels 7 to 13), coil L_5 tunes to channel 7, L_6 to channel 8 or 9, L_7 to channel 10 or 11, and the remaining inductance in the circuit tunes to channel 12 or 13 when the wafer switch S_{1B} is switched to its final position. A separate coil is not shown for this position because actually only a small length of straight wire is used. For channels 7 to 13, the "Q" of the circuit is 6 and the bandwidth is of the order of 15-25 mc. The bandwidth being so great, no special core tuning is necessary, and it becomes readily possible to receive two adjacent channels at each switch position. Since adjacent channels in the upper television band are not assigned in the same community, this arrangement is satisfactory. Each coil of switch S_{1A} and S_{1B} is tuned to the video carrier of its channel, while the corresponding coil of switch S_{1C} and S_{1D} is tuned to the audio carrier of the channel. This produces a flat-topped input response of the proper bandwith. The oscillator tube, in conjunction with the coils of switch S_{1B} and S_{1F}, provides the proper oscillator frequencies to produce the intermediate frequency. (Because of the wide bandwidth on the upper channels, it is only the setting of the local oscillator frequency which determines the station to be received.)

Before we progress any further, it should be pointed out that the output of the power supply in this receiver is divided into two sections. One section is connected between "B—" and half the total available power supply voltage. In the diagram this positive point is known as "B+." The other section is connected between the "B+" and a higher positive voltage labeled "B++." "B+" is approximately at 125 volts with respect to chassis ground and "B++" is approximately at 250 volts. Thus we have what amounts to a three-wire system, with some sections of the receiver connected between "B+" and "B—," others between "B+" and "B++," and still others between "B++" and "B—." For those stages that are connected between "B++" and "B+," the "B+" point may be considered as being equivalent to ground and the "B++" as being lowered to 125 volts. Thus, in the diagram, if the plate receives "B++" voltage, then the grid and cathode would connect to "B+." This explains why the r.f. amplifier plate connects to "B++" and its grid

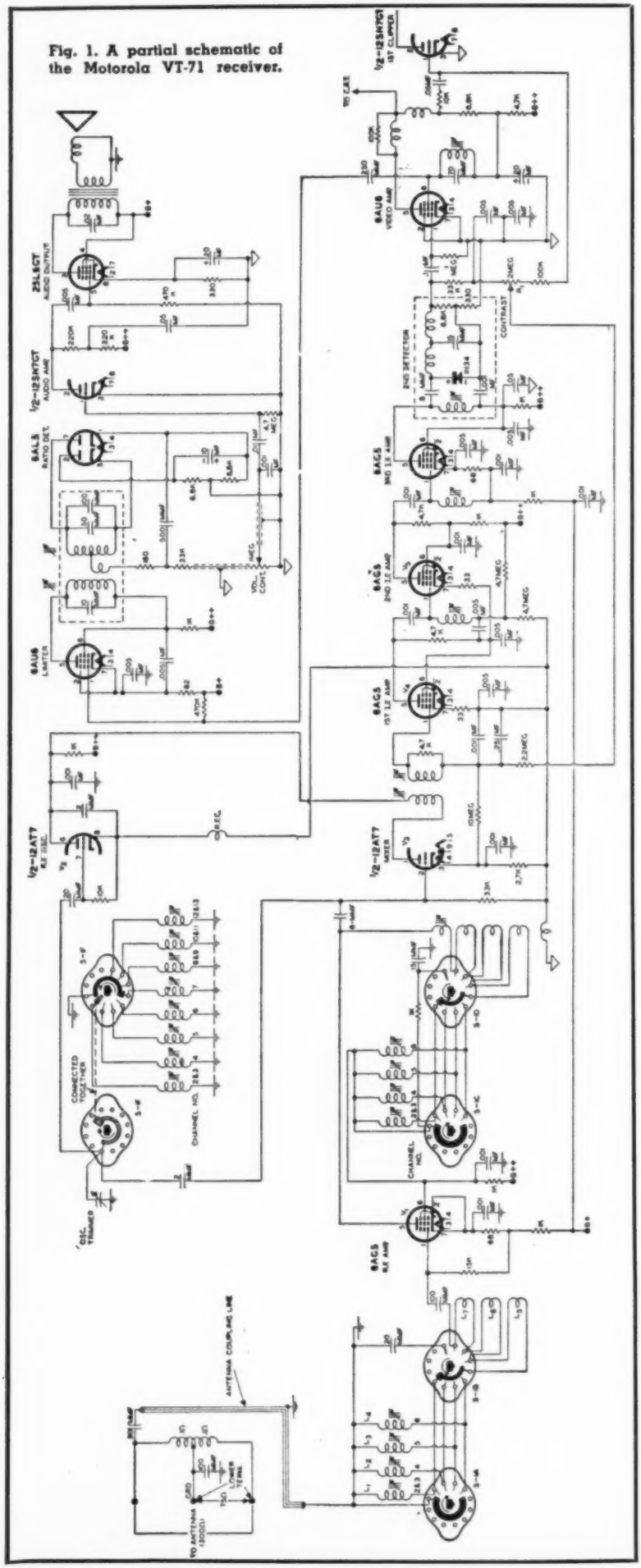


Fig. 1. A partial schematic of the Motorola VT-71 receiver.

and cathode are returned to "B+." If a tube requires 250 volts, the plate will receive "B++" voltage and the cathode will connect to "B—." Since the set contains no transformer, "B—" cannot be grounded to the chassis because of Underwriters' requirements. Circuits which have no d.c. power in them can be connected to the chassis and labeled with the familiar ground symbol.

The i.f. system contains an over-coupled transformer and three single-tuned coils. Each of the single coils are tuned to different frequencies (stagger-tuned) while the mixer transformer is purposely over-coupled to cover the total bandwidth. For channels 2 to 6, the over-all response curve of the i.f. amplifiers is shown in Fig. 2A. (This includes the mixer transformer.) The video carrier i.f. is 26.2 mc. and receives 0.6 of the full amplitude of the system. The sound i.f. is at 21.7 mc. and this signal receives only 0.1 of the full amplitude. The video carrier thus receives 6 times, or 15.6 db., more amplification than the sound carrier.

In Fig. 2B, we have the i.f. response curve for channels 7 to 13. The video and sound i.f. carriers receive the same amplification as in channels 2 to 6, but they are now located on different sides of the response curve. This can be explained if we examine the local oscillator frequency for each of the channels. See Table 1. For the lower channels, the oscillator frequency is above the carriers; for the upper channels, the oscillator frequency is below. This is possible in Intercarrier systems because of the absence of any trap circuits in the i.f. stages and the resulting approximately symmetrical response curve. Furthermore, the sound beat note frequency of 4.5 mc. is determined at the transmitter and not at the receiver. Oscillator frequency switching is not possible in conventional television sets because of the sound take-off trap and other traps usually employed in the i.f. stages. These are fixed tuned and their frequencies cannot be altered as they would have to be if the oscillator frequency position (with respect to the two carriers) were shifted. For the upper channels, the video carrier i.f. value is 22.9 mc. and the sound carrier i.f. is 27.4 mc. Note that in each instance the sound carrier is 15.6 db. below the level of the video carrier. While this is not the 26 db. suggested, it will still provide satisfactory operation.

The gain of the i.f. system is controlled by R_1, the contrast control. This control regulates the bias of the first and second i.f. amplifiers, although seemingly connection of the control is made only to the grid of the first amplifier. Examination of the circuit, however, reveals that both these tubes are connected in series. As the grid voltage of the first i.f. amplifier is made more negative, less current flows through both tubes, effectively raising the positive potential applied to the plates of each tube. Since the cathode of the second i.f. amplifier is directly connected to the plate of the first i.f. amplifier, the cathode voltage also rises. This is equivalent to a negative increase in the grid potential of the second tube. Thus, the contrast potentiometer controls the bias of the first and second i.f. amplifiers and thereby the level of the output voltage.

A second unusual feature of this system is the manner in which the automatic gain control network is tied in with the contrast control, R_1. The contrast control network, Fig. 3, consists of R_2, potentiometer R_1, and resistor R_3, all connected in series from the high-voltage side of the detector load resistor R_4 to the grid of the clipper tube. The contrast control R_1 has its movable contact connected through R_2 to the grid of V_4. A condenser, C_1, bypasses r.f. currents so that the a.g.c. circuit is not affected thereby.

One lead going to the contrast control comes from the high voltage side of the video detector. The voltage developed across the detector load resistor depends upon the signal strength and the type of image being transmitted at that particular moment. This voltage is always negative (in this circuit) and varies from a large negative value for a solid black picture to a small negative voltage on a solid white picture. The other side of the contrast control connects to the grid of the clipper tube. Now, the voltage at the grid of the clipper tube is always negative, and its amplitude is determined only by the peak value of the sync pulses. This is so because sufficient grid-leak bias is developed at this tube to prevent plate current from flowing except at the peaks of the sync pulses. This grid-leak bias is about ten times as large as the video detector voltage. Resistors R_1, R_2, and the contrast control form a voltage divider network, with each of the foregoing voltages having some effect on the voltage at any point along the divider. In actual practice the diode load voltage will have an average value of 1 to 1½ volts and the clipper grid will be held at an average value of from 10 to 18 volts. Since the voltage developed at the clipper grid depends upon the tips of the sync pulses and these, in turn, depend upon the amplitude of the incoming signal, the voltage developed at the clipper grid will serve nicely as an a.g.c. voltage. This a.g.c. voltage is fed to the grid of V_1 and controls the gain of this tube and V_2.

It may be wondered why the contrast control does not receive all of its a.g.c. voltage from the grid of the clipper tube since this is 10 times greater than the voltage the contrast control receives from the video detector. The reason is this: If the end of the contrast control now connected to the video detector were grounded, then it may happen that, in switching from a weak to a powerful station, the grid of the 6AU6 video amplifier will block due to the particular combination of time constants found in the grid circuit of this tube. Prior to the switching, the set is operating at full gain, due to the weak signal, and after switching, a powerful signal may readily overload the video amplifier before the a.g.c. voltage has had a chance to increase. As a result of the video amplifier blocking, the picture will momentarily disappear from the screen, the set will lose sync control and the negative voltage at the grid of the clipper tube will decrease to zero, permitting the i.f. amplifiers to continue operating at full gain. This will tend to further aggravate the situation. To guard against this occurring, the negative video detector voltage is fed to the other end of the a.g.c. network. Now, if a powerful signal should suddenly reach the set the average negative voltage at the detector will instantly rise, reducing the gain of the i.f. system and preventing overload of the video amplifier.

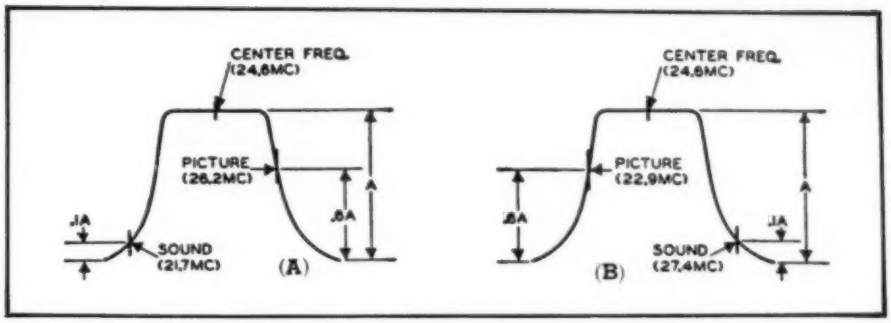


Fig. 2. (A) Over-all response curve of mixer transformer and i.f. amplifiers for channels two to six. (B) Over-all response curve of mixer transformer and i.f. amplifiers for television channels seven to thirteen.

CHANNEL NUMBER	CHANNEL FREQUENCY	CARRIER PICTURE FREQ.	SOUND CARRIER FREQ.	RECEIVER R.F. OSC. FREQUENCY
2	54-60	55.25	59.75	81.45
3	60-66	61.25	65.75	87.45
4	66-72	67.25	71.75	93.45
5	76-82	77.25	81.75	103.45
6	82-88	83.25	87.75	109.45
7	174-180	175.25	179.75	152.35
8	180-186	181.25	185.75	158.35
9	186-192	187.25	191.75	164.35
10	192-198	193.25	197.75	170.35
11	198-204	199.25	203.75	176.35
12	204-210	205.25	209.75	182.35
13	210-216	211.25	215.75	188.35

Table 1. Signal and local oscillator frequencies for each television channel.

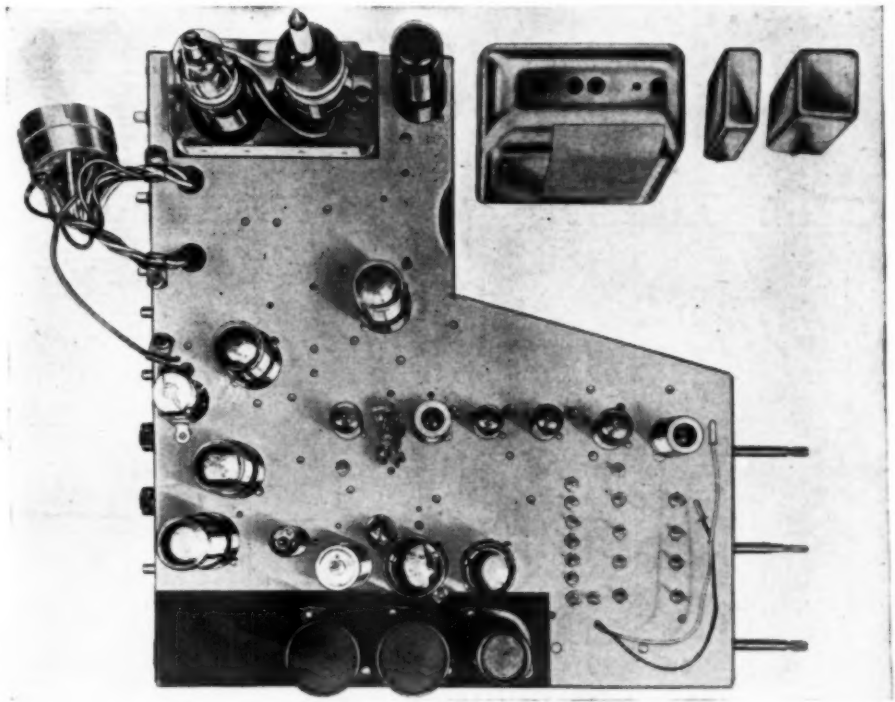
Thus we see that while the voltage fed into the a.g.c. system from the video detector is ordinarily unimportant, it does become important if the video frequency amplifier should become blocked by a sudden rise in the signal voltage.

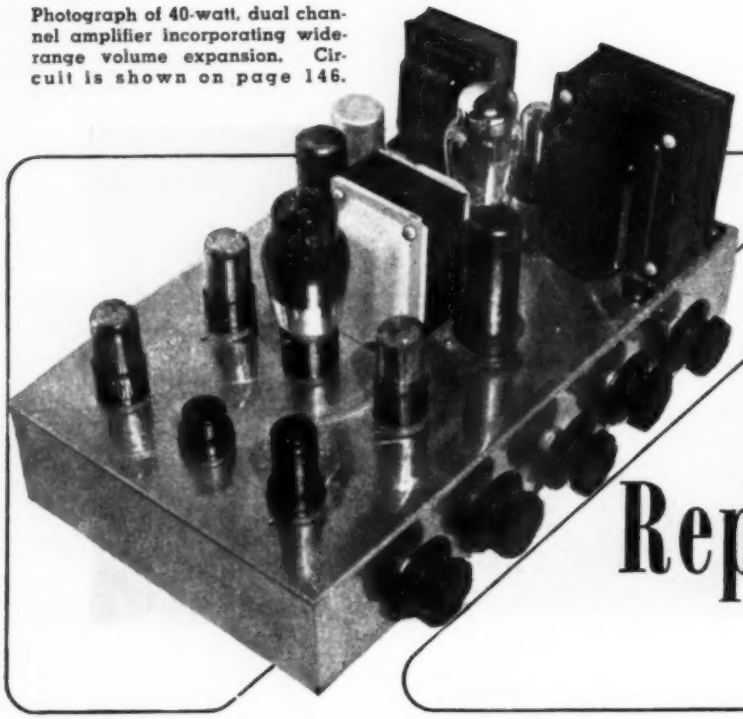
The video detector uses a 1N34 germanium crystal as its rectifier. The crystal also functions as a converter, providing the 4.5 mc. difference frequency which contains the audio intelligence. A low pass filter is included to prevent i.f. voltages from reaching the amplifier.

The signal output of the detector is fed to a video-frequency amplifier which is designed to function, too, as a partial limiter tube. The output of the video detector is in the negative direction and noise peaks drive the video amplifier beyond cut-off, thus being clipped. The 4.5 mc. beat note

(*Continued on page* 84)

Top chassis view of the Motorola VT-71 Intercarrier Television receiver.





Photograph of 40-watt, dual channel amplifier incorporating wide-range volume expansion. Circuit is shown on page 146.

A Three-Dimensional Reproducer System

By MICHAEL WOLFE

By adding volume expansion-compression and dual channel operation, you can attain greater "depth" in your audio.

ALTHOUGH the binaural nature of sound is seldom mentioned in discussions of high fidelity, it offers an important and fascinating field of experimentation to the audio enthusiast.

Binaural perception means the ability to perceive the direction from which a sound is coming. A few moments' reflection is enough to establish how unnatural it is to have a wide variety of sounds, such as those produced by a ninety-piece orchestra, issue from a fixed source of perhaps twelve inches in diameter.

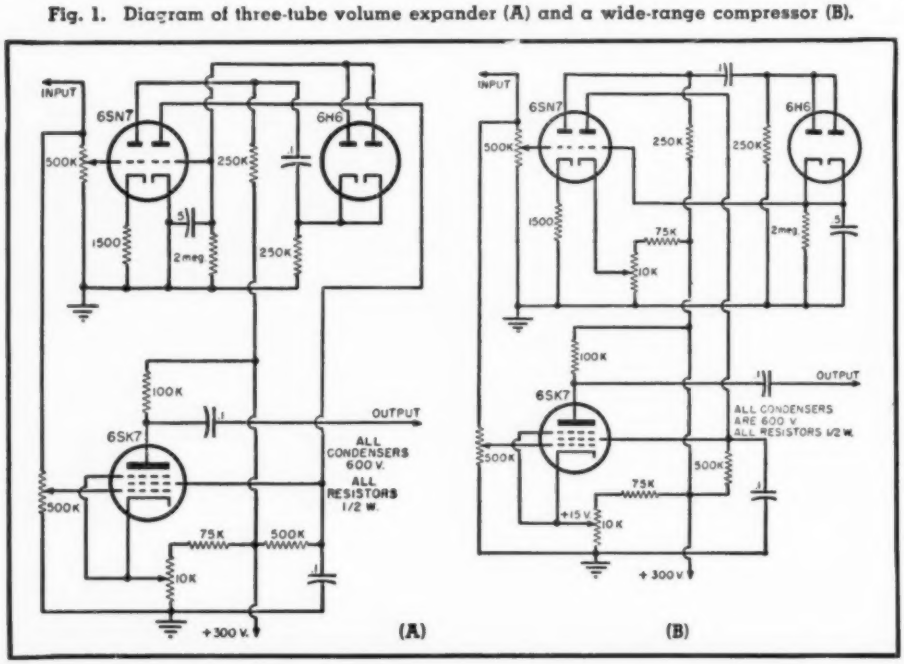
Ideally, a separate channel of reproduction would be used for each instrument with a multiplicity of loudspeakers spread about in proper locations, though in common practice two or three channels are sufficient to give very excellent reproduction.

Commercially, binaural transmission and recording has been almost ignored due to the greatly increased cost of multiple channel operation, but recently, systems have been developed to achieve a very interesting effect of binaural reproduction from conventional single channel sources.

As far back as 1930, it was suggested that greater naturalness might be achieved from ordinary transmissions by placing a loudspeaker on either side of the room, with the low notes fed to one speaker and the highs to the other. In orchestral music, this would tend to separate the string basses, kettledrums, and other low-register instruments from the high-register instruments, such as flutes, piccolos, and triangles. An arrangement of this nature is quite easy to construct and operate. A dual channel amplifier like the one described later is recommended for flexibility and ease of control, and for the most desirable results the operating ranges of the two channels should overlap to a certain degree to prevent sudden discontinuities.

As human ears can tell the direction of a sound by measuring the relative phase difference between the vibrations striking each ear, a somewhat similar system may be built by the deliberate introduction of phase distortion into two amplifier-speaker systems. A thousand-cycle note coming from a right angle will represent a phase difference to the two ears of nearly 180 degrees and zero degrees difference when coming from straight ahead. With sound coming at an angle, the phase difference at low frequencies is very small but increases with an increase in frequency.

Fig. 1. Diagram of three-tube volume expander (A) and a wide-range compressor (B).



By making use of this effect, results are obtainable that can be achieved in almost no other way. If two amplifiers are used having similar frequency characteristics but different phase shift characteristics, and the outputs are applied to identical speakers placed on either side of the room, acoustic images are formed at various frequencies, giving the effect of a large number of reproducers around the room. A variable phasing control was included in an experimental setup, with the result that it was possible to change the apparent position of the string section of an orchestra over a distance of ten feet. When the phase shift is relatively great over a narrow frequency range, the very unusual effect of a rapidly moving sound source is obtained during orchestral passages where a particular instrument falls within this range.

Although ideal from several standpoints, this system has the drawback that careful attention must be paid to controlling the phase shifts, not only in the amplifier and associated apparatus, but in the speakers and room acoustics as well. Wall reflections may generate large amounts of phase distortion, making the problem one of designing a system for a particular speaker and listener location, and for this reason no detailed circuits will be given here.

A third effective system for achieving binaural reproduction makes use of the dynamic characteristics of music — automatically distributing sound to various portions of the room in accordance with the energy or frequency content.

This system rests on the use of volume compressors and expanders capable of ratios of more than twenty to one with relatively low distortion. Two amplifiers are employed in the simplest form: a small, low-powered amplifier, to carry the quiet passages, and a higher power amplifier fed through a volume expander that comes into operation during the high level passages and feeds a speaker placed on the opposite side of the room. During quiet passages usually only one or a few instruments will be playing, and they will appear to come from one side of the room. As the volume level increases the other amplifier will operate, giving the effect of other instruments joining in from the opposite side of the room. If desired, a compressor may be used to cut out the first amplifier altogether at high volume levels. Using these basic elements a great number of variations are possible. The frequency range of the low power amplifier may be limited to cut off scratch and turntable rumble providing dynamic noise suppression, and other forms of dynamic frequency variation may be achieved through the use of tone networks on the two amplifiers. Special gating systems may be used to operate separate amplifiers when only high frequencies, low frequencies, or a combination are present.

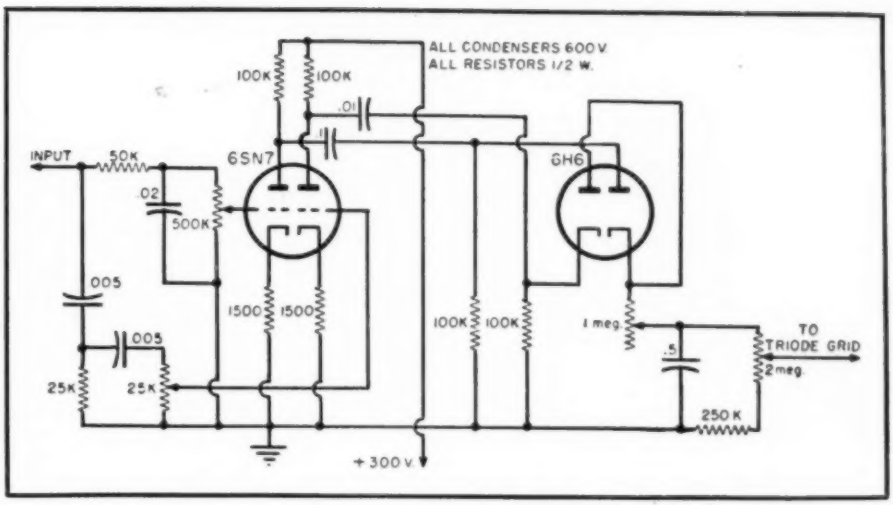


Fig. 2. Diagram of frequency discriminator system to be used in conjunction with an expander or compressor. Circuit can be used to expand highs or compress lows. Low-frequency expansion or high-frequency compression may be achieved by reversing the two diode sections. Unit also features variable attack and release controls.

The compressor-expander circuits used differ from conventional types in that the control signal is applied to the screen grid of a variable mu pentode. This has the advantage that relatively low filtering of the signal voltage is needed and the fact that the expander circuit cannot be overdriven by the control voltage. The operation of either circuit is effected by varying the plate resistance of a low mu triode, the plate of which is connected to the screen grid of a variable mu pentode. An appropriate d.c. voltage is applied to the grid of the triode, changing its effective plate resistance which, through a voltage divider action, changes the screen voltage of the pentode, consequently changing the transconductance.

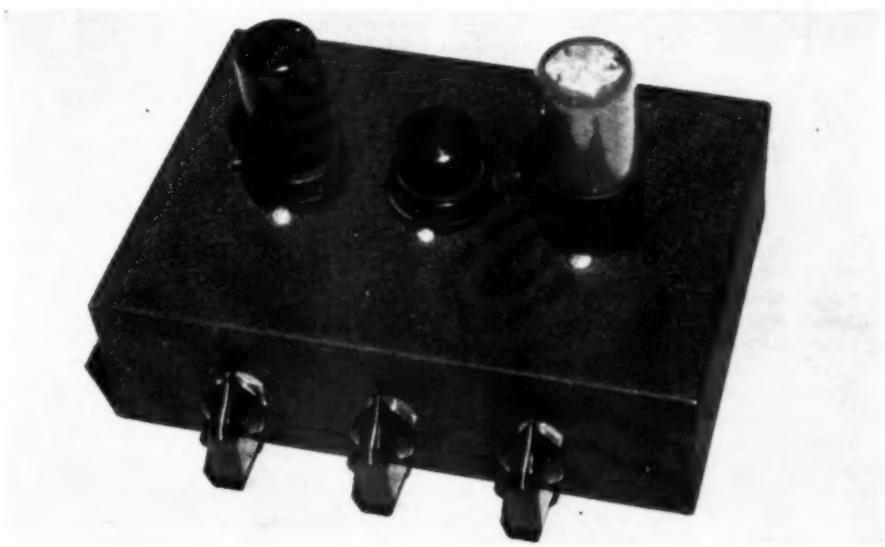
Distortion introduced by this circuit is desirably low and consists almost entirely of second harmonic distortion that can be eliminated through using two pentodes in push-pull if desired. For single ended operation, distortion is greatest at maximum compression, and measurements showed that eight per-cent second harmonic distortion could be expected at a compression ratio of twenty to one, with a one-half-volt input to the grid of the 6SK7. Halving either the compression or the input voltage will halve the distortion. In practice, the circuit functions smoothly from inaudibility to full power output.

The time constants of the compressor-expander circuits will generally represent a compromise of several factors. If the time constants are small, the switching action may be unpleasantly jerky. If the time constants are large, a smooth switching results, but sharp dynamic effects may suffer. In the system presently used by the author a time delay of about one-half second is used. On percussive passages this gives the effect of two sets of instruments, with one set taking the first beat and the other set finishing the passage.

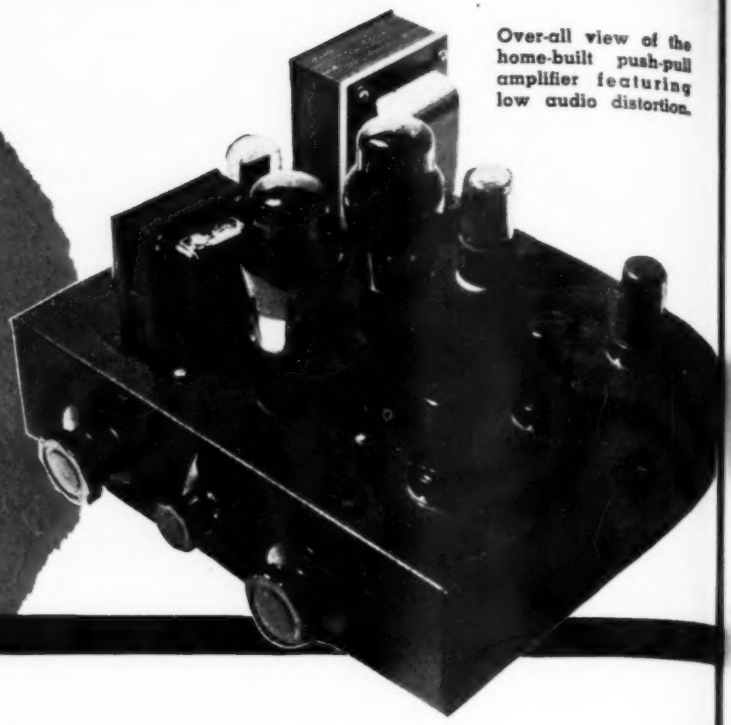
Schematics of the compressor and

(*Continued on page* 146)

Photograph of a compact expander unit that may be used with existing equipment.



AUDIO TRANSIENT DISTORTION



Over-all view of the home-built push-pull amplifier featuring low audio distortion.

By
GLEN SOUTHWORTH

A loudspeaker correction system is incorporated in a novel amplifier that has good transient response.*

GOOD transient response is important, not only in equipment designed for high-quality musical reproduction, but as a factor to be seriously considered by the radio amateur, communications man, and public address operator. In the case of musical reproduction, good transient response means the ability to respond readily to complex wave patterns with low distortion and the corresponding ability to reproduce complicated instrumental passages clearly with a minimum of spurious tones generated by the equipment itself, while in communications or public address work, the operator will find himself repaid with higher intelligibility by paying careful attention to the design of his audio system.

Although serious transient distortions may occur in almost any part of audio equipment, the worst distortions usually are discovered in electromechanical devices, such as pickups or speakers, due to the physical inertia of these devices. A considerable amount of material on various types of pickups has been generally available in recent years, including both commercial and home constructed types; however, there are several factors worth noting. A number of excellent pickups on the market today are capable of wide-range, low-distortion output but can cause excessive record wear. Stiff moving elements and worn or chipped needles are usually the worst offenders and may cause a great deal of noise and distortion on loud passages or certain tones due to the needle's digging into the side of the record groove; surface noise or scratch will often be greatly increased on the playback by a defective needle, due to the lessened damping effect of the groove. For these reasons, many people have in the past preferred to use cactus or soft steel needles, even in connection with wide-range equipment. However, the present trend in pickup manufacture is toward lightweight pickups with high needle compliance, thus combining low distortion and record wear with wide-range reproduction. Transient distortions in pickups usually occur in the upper audio ranges and may often be detected by using a sweep frequency record in connection with an oscilloscope, as this approximates the interrupted tone technique described in the preceding article.

For several reasons, little detailed information is generally available on the subject of loudspeakers, but the effects of various types of speaker baffles and enclosures are quite well known, and a considerable amount of excellent material has been published on this subject. The fact that loudspeaker performance may be greatly influenced by the type of amplifier used with it is also quite well known, but considerable controversy has existed on this subject in recent years.

A loudspeaker may be considered a motor-generator having one or more resonant elements. These resonant elements will not only cause an increase of sound pressure at certain frequencies but will continue to oscillate after the exciting impulse has ceased. If resistance is inserted into a resonant circuit, the "Q" of the circuit will be lowered, these oscillations will die out more rapidly, and the sound pressure variations will not be so great. This resistance may be mechanical in nature, due to the speaker construction, or acoustic resistance, obtained by proper loading of the speaker by the associated enclosure. A third method relies on the fact that the speaker acts as a generator and produces a back e.m.f. When this voltage is developed across a relatively low impedance, such as provided by a triode output amplifier, a considerable braking effect may take place with consequent damping of speaker oscillations. It is important to note, however, that this braking effect will be dependent upon the loudspeaker efficiency, and for good results, speakers with very heavy magnetic fields and capable of attaining efficiencies three or four times that of common speakers may be used in high-quality installations. The apparent low-impedance output of triodes may be achieved by multi-element tubes in several ways. The simplest of these is to place a high-wattage resistor of low value in parallel with the speaker voice coil. A more common method is to use fairly large amounts of inverse feedback over the output stage of the

* The author presents herein a practical construction type article based on his theoretical analysis of audio transient distortion presented in the April, 1949, issue of RADIO & TELEVISION NEWS.

amplifier. This system has the disadvantage that the voltage reflected by the speaker will be in-phase at only two points in the frequency range. Fortunately, one of these points is the primary resonant frequency and relatively good damping can be achieved at this point. In the high frequency ranges, however, the voltage developed by the speaker may be greatly out-of-phase with the amplifier output and lead to dynamic instability in some instances.

The importance of inverse feedback has long been recognized in dealing with electrical distortions, and with proper care it can be used to reduce mechanical distortions occurring in conventional loudspeakers. Advantage may be taken of the fact that the speaker acts as a generator as well as a motor. In this case, an electrical replica of the physical vibration of the loudspeaker will appear at the amplifier output and may be fed back into the amplifier to provide electrical compensation for speaker defects. In doing this, two problems must be overcome. First, the voltage developed by a speaker of ordinary efficiency will be only a small fraction of the amplifier output, and a means must be found of separating this small voltage, or excessively heavy feedback with its attendant problems will be required. Second, the voltage developed by the speaker will vary greatly in phase over the audio range and high-frequency phase correction should be used in the feedback loop. A simple solution to these problems is shown in the circuit illustrated in Fig. 1. A bridge circuit is used to balance out most of the voltage developed by the amplifier, leaving the out-of-phase voltage developed across the loudspeaker, plus any voltages that may be developed by impedance variations of the speaker. The output of the bridge is then passed through a simple phase shifting network and applied to one of the amplifier voltage stages. In most conventional, single radiator speakers, phase shift increases in a positive direction with ascending frequency, and resistance capacitance phase-shifting systems may be used with little difficulty.

The results attainable with speaker compensation of this nature are very good indeed, performance of conventional twelve-inch speakers being comparable with expensive, two-way speaker systems using horn loading. Although use of large diameter radiators for reproducing high frequencies is unconventional in high-quality sound systems, excellent results were achieved by the author, with high-intensity, wide-range reproduction being obtained from a single speaker with a minimum of distortion. Musical reproduction with high-frequency intensity at levels of near physical sensation have been experienced for periods up to six hours, with a minimum of listening fatigue. Excellent reproduction of instruments with sharp transients, such as piano, kettledrums, chimes, cymbals, etc., is achieved.

This circuit has been tested with a variety of different amplifiers and speakers with marked improvement in every case, but for best results it is recommended that the constructor get a speaker with reasonably good performance to start with and preferably with as heavy a field or magnet as possible. A speaker of high efficiency will permit more effective adjustment of the feedback loop. Although this system has been designed primarily for use with a single speaker, excellent results may be achieved by using two speakers in series. Of course they should be of proper phasing and, if of different manufacture, should be tried in different connections for best results.

The circuit of a low-powered amplifier using bridge type feedback is shown in Fig. 2. This circuit incorporates several interesting features such as a variable feedback and phasing control and provision for triode or beam power output tubes. This circuit makes a decided improvement in reproduction when using either triodes or multi-element tubes, and with full feedback the difference in operation is unnoticeable. However, in some instances it may be desirable to provide a moderate amount of "hangover" in the bass frequencies in order to achieve an effect of live acoustics, or to soften hard tones or a number of other effects; the high resistance output tubes, such as 6L6's, make a wider range of control possible and provide extra power output.

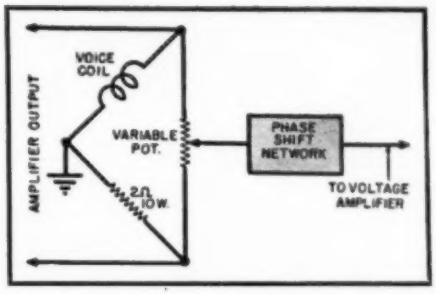
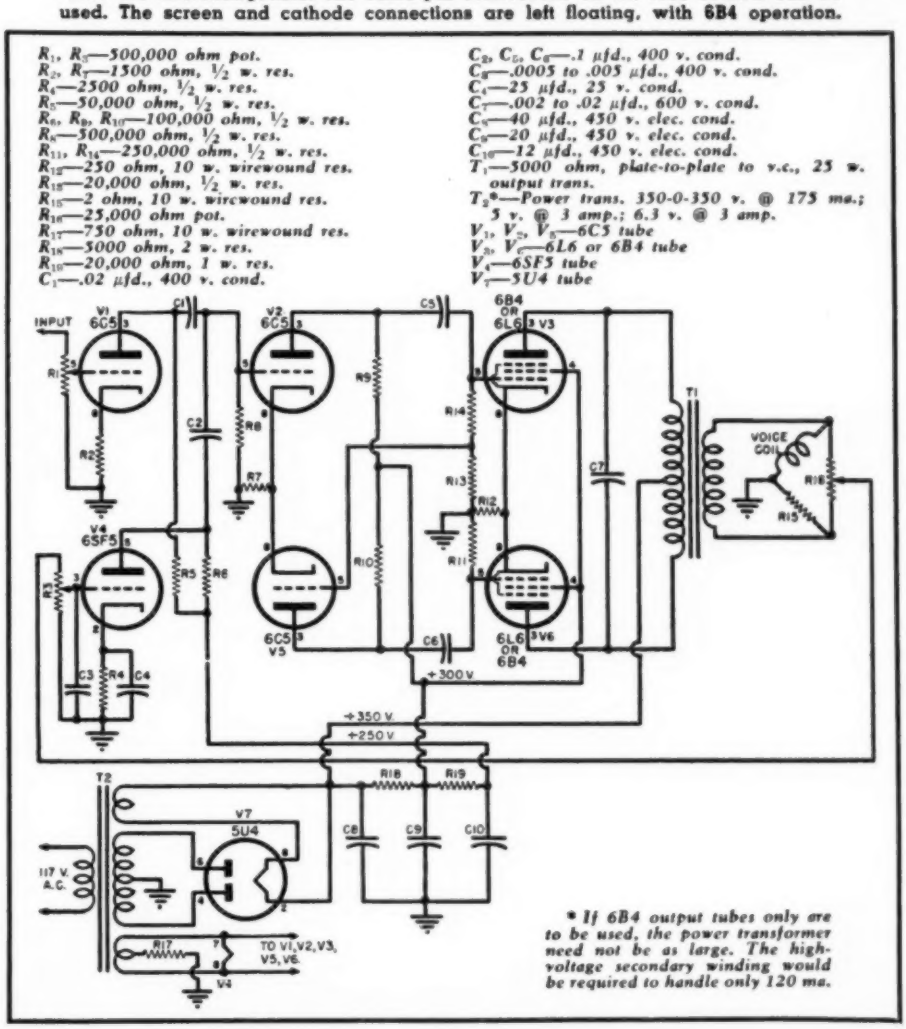


Fig. 1. Diagram of basic bridge circuit that may be incorporated in existing equipment. Care should be taken to maintain the proper phase relations throughout the circuit.

Several factors should be noted in connection with the feedback loop. First, the polarity of the amplifier output must be correct, and the out-of-phase voltage should appear across the side of the bridge containing the loud speaker. Second, in designing a feedback loop, the constructor may have

(Continued on page 92)

Fig. 2. Diagram of amplifier using bridge-type feedback with provision for variable feedback control and triode or beam power output tubes. The 6B4 or 6L6 power tubes are interchangeable. The same pin connections on the tube sockets can be used. The screen and cathode connections are left floating, with 6B4 operation.



** If 6B4 output tubes only are to be used, the power transformer need not be as large. The high-voltage secondary winding would be required to handle only 120 ma.*

A Simple *Television* TUNER

By J. T. GOODE

Television receivers that cover only the low frequency band need not be obsoleted. Add this low cost tuner to your present set and obtain 5-channel coverage—two high band and three low band, or your choice.

MANY of the early television kits covered only the low band with the result that their owners have only limited reception. The tuner described here will enable these owners to add the high band to these sets, making a total coverage of five channels. The details of construction will vary with the particular set being altered, but every effort should be made to keep all leads as short as possible.

The tuner described will permit your present receiver to tune to two of the high band channels and three of the low band. With the necessary alterations on the coils specified, it is possible to place any of the five channels in either the high or low band as desired, or any desired combination.

To alter the coils, some experimenting will be necessary to determine the proper number of turns. Due to the frequencies involved, with the attendant importance of lead lengths and parts placement, it is not possible to give the specifications for these different coils.

The tuner is designed to replace the present tuner in sets covering only the low-frequency channels. The old tuner and its associated parts should be removed and replaced with this new unit. If your television receiver will now tune all twelve channels, the author does not recommend building this to replace the one now in service. Although this tuner may in some respects operate more satisfactorily than your present one, the difference will be in the order of a few db. that may not be noticed in actual operation.

The circuit of this tuner is extremely simple. It consists of a 7F8 dual triode using one-half for the oscillator and the other half as a mixer. The antenna is fed into the grid of the mixer. The plate of the mixer feeds into your present i.f. channel.

This television tuner requires a minimum of parts and is comparatively simple to construct. The use of a signal generator to adjust the coils will simplify the problem, but if a generator is not available the coils can be adjusted on a received signal.

The antenna input circuit consists of condenser C_1 and load resistor R_1. Condenser C_2 feeds the antenna circuit to the grid of the mixer stage. The mixer grid circuit consists of a series coil arrangement, whereby L_1 is attached to number one contact on the switch and fed to the grid through coupling condenser C_3. This condenser breaks the d.c. path allowing injection voltage to develop across grid resistor R_2. Condenser C_4 couples the oscillator to the mixer grid.

The arm of the switch connects to ground. When the switch is in number one position, only one coil will be in the circuit and this will be tuned to the highest frequency channel. The first and second contacts are tied together with number 20 wire. This will set the inductance for the next high-frequency channel. Three low-frequency channels are covered by L_3, L_4 & L_5. The plate of the mixer connects to the primary of the first i.f. transformer. Condenser C_6 is the oscillator grid condenser, and resistor R_3 is the grid leak. R_4 is the oscillator plate filter resistor.

A Colpitts oscillator circuit is used. Normal Colpitts construction consists of a split stator condenser shunting the oscillator inductance with the rotor going to ground, forming a capacity center tap. The capacity center tap of this circuit is formed by condensers C_5, C_6, and C_8.

Condenser C_8 is a 5 $\mu\mu$fd. variable condenser which is used for the oscillator and is available from the front panel. By connecting C_5 in series with this capacity, a rather long lead can run between the bandswitch and the oscillator condenser which must be on the front panel without upsetting the oscillator coils. By using the leads attached to C_8 a span of two or three inches can be tolerated. L_6 and L_7 are the high-frequency oscillator coils. L_8, L_9, and L_{10} are the low-frequency coils.

The lowest frequency oscillator coil is shunted by condensers C_9, C_{10}, and C_{11}. These condensers were added to this low-frequency channel to reduce the number of turns in L_{10}. A coil with more than twenty turns presents a mounting problem on the band switch.

Coil Construction

L_1. Three turns of number 20 copper tinned wire with an i.d. of 3/16ths, spacing between turns 1/16th.

L_2. Short switch contacts with number 20 wire.

L_3. Seven turns of number 24 silk enamel wire close-wound.

L_4. Five turns of number 20 copper wire spaced 1/32.

L_5. Five turns of number 20 copper wire spaced 1/32.

L_6. Two turns of number 16 copper wire spacing 1/16th.

L_7. Three turns of number 16 copper wire spacing 1/16th.

L_8. Thirteen turns of number 24 silk enamel closewound.

L_9. Twenty turns of number 24 silk enamel closewound.

L_{10}. Twenty turns of number 24 silk enamel closewound.

All coils with the exception of L_6 are ¼ i.d. The coils are wound on a ¼ inch rod and then slipped off the form. The closewound coils should be dipped in coil dope and allowed to dry before mounting.

The bandswitch is a standard two-deck, four-pole five-position switch. One section is not used. Notice when the switch is rotated to one extreme the amount of inductance in the switch arm is minimum. When rotated to the

other extreme the arm inductance is maximum. Number one contact will be the contact nearest the arm contact. The mounting of the mixer coils is shown in Fig. 1.

Connecting the coils to the switch in this manner is important. L_6 has only two turns of wire. Connecting L_6 to number five switch contacts would result in even less wire to hit the highest frequency channel. The oscillator coils are mounted on the back switch deck. One end of the coils connects to one set of contacts and the other end of the coils to the other set of switch contacts. Fig. 2 shows the details of this mounting.

The mixer grid coils also connect directly to the front switch deck. By mounting oscillator coils on both sides of the rear switch deck, adequate space is available. Mount the coils in such a way that they are available for adjustment. The location of the 7F8 tube socket must be close to the channel switch and, if possible, directly under it. This will keep all critical lead lengths to a minimum.

Keep all leads as short as possible. The cathodes of the 7F8 should be grounded right at the socket. The ground lead going to the mixer switch arm should be number 16 wire grounded at the same point as the cathodes. All fixed condensers should be ceramic. Zero temperature coefficient condensers will reduce oscillator drift, and are recommended.

Tuning Procedure

Due to the high frequencies involved, the lead length in wiring will undoubtedly necessitate coil adjustment. The coils described cover channels 2, 4, 5, 9, and 13 in a receiver using the old low-frequency i.f. channels, approximately 12 mc. If your receiver has a high-frequency channel, approximately 25 mc., it will be necessary to reduce the inductance of the oscillator coils slightly. Since the coils must be adjusted this presents no hardship.

First determine the oscillator frequencies required to cover five channels. Add the i.f. frequency to the channel frequency which will give the proper oscillator frequency. This must be done for each channel. Use the center frequency of each channel for this calculation.

Turn on your receiver and proceed to adjust each oscillator coil so that it covers the desired frequency range when condenser C_6 is in center position. This adjustment consists of spreading turns or pushing turns closer together. If the frequency is too low it may be necessary to remove a turn from the coil. On the other hand, if the frequency is too high it will be necessary to wind a new coil with an additional turn.

If a calibrated signal generator is available, the oscillator coil adjustment can be made with very little effort. Connect the generator to the antenna terminals and adjust the oscillator coils to cover the desired frequencies.

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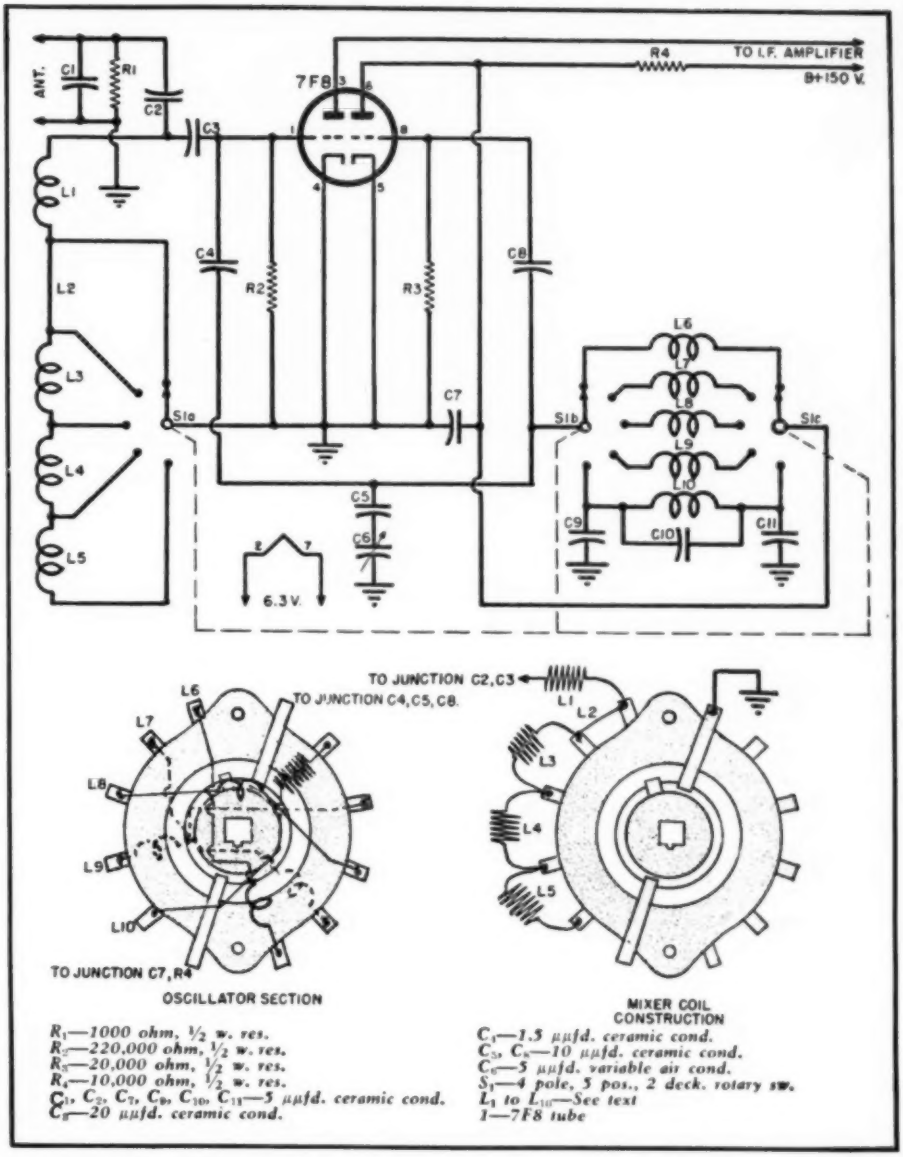

Fig. 1. Schematic diagram of TV tuner. A conventional Colpitts oscillator circuit is used.

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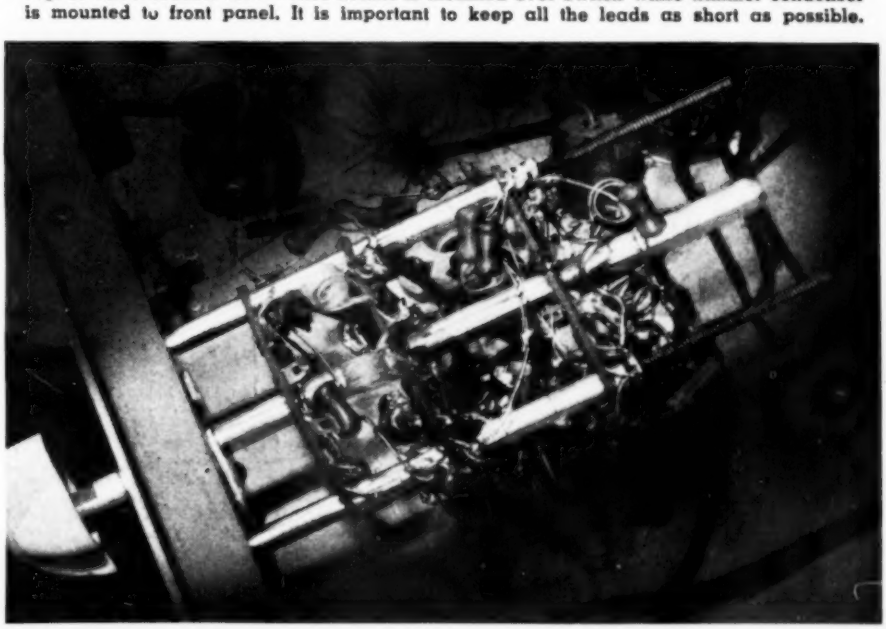
Fig. 2. Underchassis view—tube socket is mounted over switch while trimmer condenser is mounted to front panel. It is important to keep all the leads as short as possible.



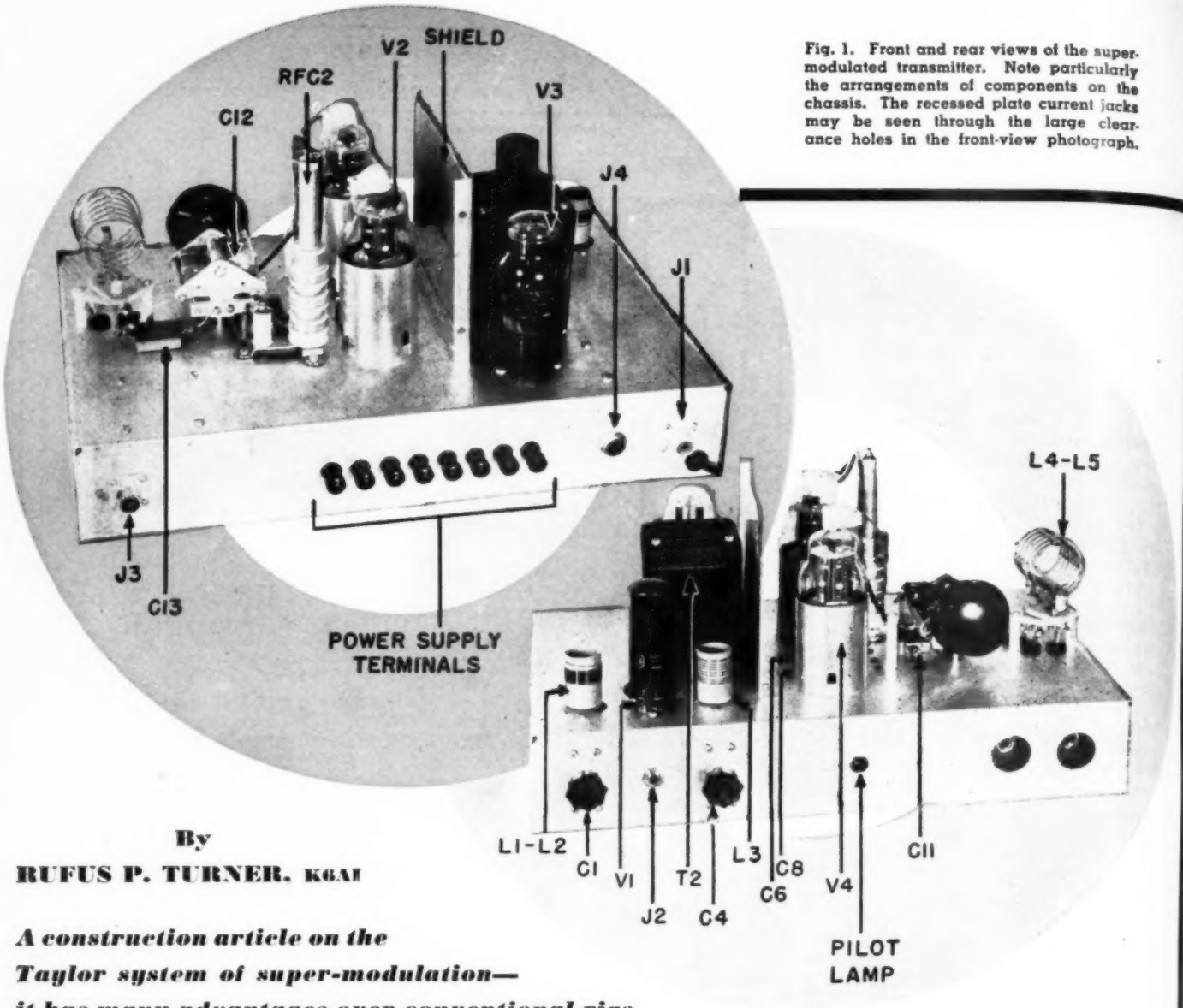


Fig. 1. Front and rear views of the super-modulated transmitter. Note particularly the arrangements of components on the chassis. The recessed plate current jacks may be seen through the large clearance holes in the front-view photograph.

By

RUFUS P. TURNER. K6AM

A construction article on the Taylor system of super-modulation— it has many advantages over conventional rigs.

THE Taylor system of super-modulation certainly is worth the attention of every ham who wants the best in amplitude modulation but neither cares to run a veritable audio powerhouse to get it, nor put up with the poor efficiency of grid, screen, or cathode modulation.

The patented Taylor system[1] disposes of the high-powered audio stage and its power supply, the costly high-level modulation transformer, and the necessity of impedance matching between modulator and final amplifier. At the same time, this new system affords outstanding advantages which include the following.

(1) The final r.f. amplifier tube may be run at its full c.w. input rating, since the modulation process does not increase the plate input. This permits the fullest use of small tubes which ordinarily are unattractive in AM transmitters.

(2) The carrier is reduced automatically during modulation, reducing heterodyne interference at the receiving location and narrowing bandwidth. At the same time, the side bands are emphasized, yielding a characteristic "punch" which other types of amplitude modulation (all other things being equal) do not exhibit. A super-modulated signal is easily picked out by its surprising loudness and sharp tuning.

(3) During positive modulation, the plate input power to the final amplifier actually is reduced, giving this tube a cooling interval similar to the key-up period in c.w. transmission.

(4) In the Taylor circuit, the modulator is an audio-operated r.f. stage, not the power audio stage of conventional AM modulation. The modulator is triggered into operation by the audio wave to feed additional r.f. energy to the final amplifier tank. This additional energy brings the r.f. output up to the level of positive amplitude modulation. (For example, the modulator will boost the original carrier to twice its value in 100 per-cent modulation).

(5) Little r.f. and audio exciting power are required. The r.f. excitation is intermediate between c.w. and plate-modulated phone requirements for a given tube.

(6) The final r.f. amplifier and modulater are operated from the same high-voltage power supply, resulting in a considerable saving.

(7) Plate efficiency is the high value obtained heretofore in c.w. and conventional plate modulation.

Considerably more "talk power" is discerned in a signal from a super-modulated transmitter than from conventional AM rigs of the same plate power input. This particular advantage of super-modulation, while beneficial at all power levels, is of special interest to users of low and medium-power transmitters in power-competitive amateur channels.

For a detailed explanation of super-modulation circuit operation, the

[1] *The Taylor "Super-Modulation" Principle.* R. E. Taylor RADIO & TELEVISION NEWS. September, 1948, p. 42. Part 2 in the October, 1948, issue, page 44.

A SUPER-MODULATED, LOW-POWER PHONE TRANSMITTER

reader is referred to Mr. Taylor's two articles.[1]

The super-modulated transmitter described in this article has been developed around type 807 tubes in the r.f. amplifier and modulator, since we believe these tubes are representative of the popular inexpensive, low-powered, low-excitation group. In designing the rig, we have recognized that most amateurs have an external power supply, speech amplifier, and exciter (v.f.o. or crystal) of some kind which may be connected easily to the super-modulated rig. Satisfactory terminals and jacks accordingly have been provided for feeding in low-level audio and r.f. and for connecting the power supplies. If an individual builder chooses, however, he may include the power supplies, one or two additional speech amplifier stages, and an oscillator and one doubler on the same chassis. These additional stages will be entirely conventional.

Description

Fig. 2 is a complete circuit schematic of the super-modulated transmitter. The following paragraphs describe the various portions of the circuit separately.

One of the 807 tubes, V_2, is the final r.f. amplifier. This tube operates in a conventional manner, except that its grid bias voltage is somewhat higher than ordinarily is used in Class-C operation. The second 807, V_4 is the modulator tube and its plate is connected across a portion of the tank coil, L_4.

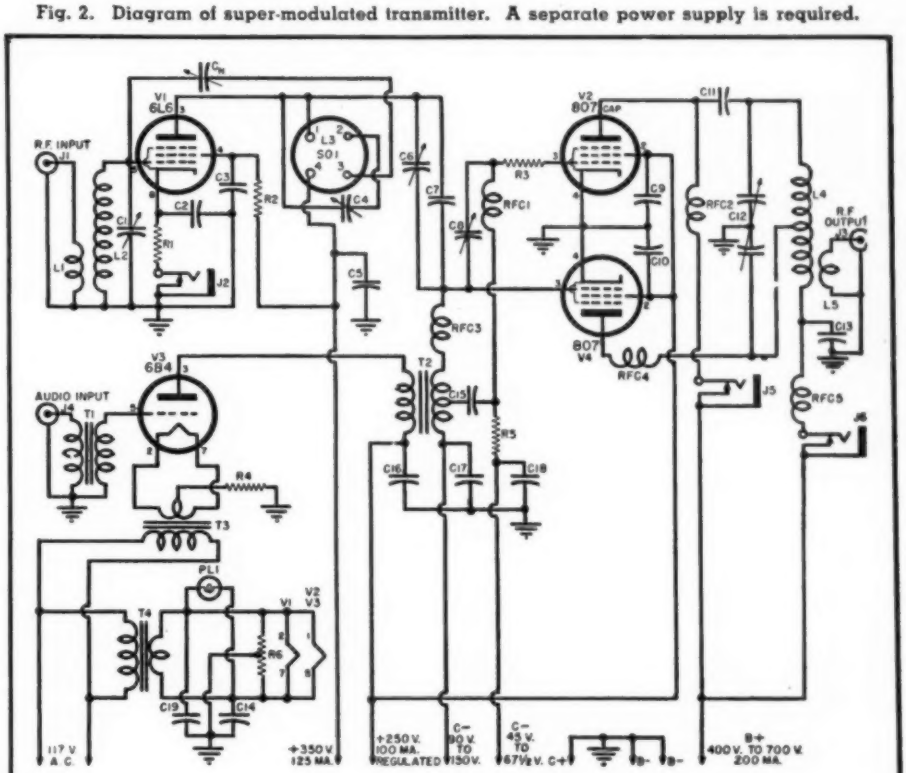
The r.f. from the 6L6 driver stage is fed to both 807 grids through the capacitance-coupling network consisting of C_6, C_7, and C_8. The grid of V_4 is connected to the midpoint of the capacitive network. The condensers in this network act as a radio-frequency voltage divider. Through voltage divider action, different values of r.f. excitation voltage are applied to each 807 grid. Condensers C_6 and C_8 are made variable so that the operator may select optimum r.f. voltage for each grid. At the correct setting of C_6 and C_8, r.f. excitation to the amplifier tube, V_2, will be reduced sufficiently during positive modulation to "knock down" the input of V_2 and accordingly reduce the carrier. Before audio voltage is supplied by the secondary of transformer T_2, tube V_2 supplies most of the r.f. energy to the final tank, C_{12}-L_4. Tube V_4 is highly biased and accordingly supplies very little.

The 6L6 r.f. driver stage acts as a straight-through neutralized amplifier on 80 meters and as a doubler on the two other phone bands, 20 and 10 meters. This stage has sufficient r.f. reserve capability to meet the demands of the super-modulated final amplifier.

From an external low-level exciter unit 80, 40, or 20-meter input is fed into the r.f. input jack, J_1, to give operation on 80, 20, or 10 meters.

The audio driver stage employs a 6B4-G tube, chosen for its good regulation which is essential in this application. This stage is operated Class-A_1. Low-level audio input voltage is delivered to the 6B4-G through the line-to-grid transformer T_1, the primary of which is connected to the audio input jack, J_4. The primary of T_1 may be designed either for a 200 or 500-ohm line. The output transformer in the external speech amplifier must have a secondary impedance of the same value. For most amateur crystal microphones, the external speech amplifier need not be more complicated than a high-gain pentode input stage followed by one or two resistance-coupled triodes. These speech stages may be incorporated into the external exciter or v.f.o. unit to make a compact desk-top control unit. If T_1 has a 200-ohm primary, a carbon microphone and battery may be connected directly to Jack J_4 to give satisfactory performance.

Fig. 2. Diagram of super-modulated transmitter. A separate power supply is required.



R_1—400 ohm, 10 w. wirewound res.
R_2—50,000 ohm, 2 w. res.
R_3—50 ohm, 2 w. res.
R_4—750 ohm, 5 w. wirewound res.
R_5—2000 ohm, 10 w. non-inductive res.
R_6—100 ohm, center tapped, wirewound res.
C_n—Low capacitance neutralizing condenser (3-4 μμfd. range) National NC-600
C_1, C_2—30 μμfd. midget var. cond. National UM-50
C_5—.01 μfd. mica cond.
C_3, C_9, C_{10}—.002 μfd. mica cond.
C_6, C_8—100 μμfd. midget var. cond. National UM-100
C_7—150 μμfd. midget silver mica cond.
C_{11}, C_{13}—.002 μfd 1500 v. mica cond.
C_{12}—Dual 100 μμfd. var. cond. .026" spacing. National TMS-100D
C_{14}, C_{19}—.1 μfd. 200 v. cond.
C_{15}, C_{17}, C_{18}—2 μfd. 400 v. cond.
C_{16}—8 μfd. 450 d.c.w.v. midget elec. cond.
RFC_1, RFC_3, RFC_5—2½ mhy. 125 ma. pi-wound r.f. choke
RFC_2—225 μhy., .6 μμfd. special shunt-feed r.f. choke National R-175
RFC_4—6 t. solid hookup wire ⅛" in dia. stretched to winding length of ¾ inch (Coiled lead from 807 plate)
J_1, J_3—Coaxial female chassis jack Amphenol 83-1-R
J_2, J_5, J_6—Midget closed-circuit jack
J_4—Coaxial female chassis jack Amphenol 80-C
L_1, L_2, L_3—See r.f. Driver Coil Table (Table I)
L_4, L_5—75 w. coils with center tap added (See text)
T_1—200 or 500 ohm line to single Class A grid trans.
T_2—Class B driver trans. (Single 2A3, 6A3, or 6B4-G to push-pull Class B grids) Peerless D0-26A
T_3—6.3 v. 1 amp. center tapped filament trans.
T_4—6.3 v. 3 amp. filament trans.
PL_1—6.3 v. pilot lamp

	L_1	L_2	L_3
80 METERS	2 turns No. 20 enamelled wirewound self-supporting around inside of coil form near cold end of L_2.	50 turns No. 26 enamelled wire on 1"-diameter form. Winding length 1 inch.	50 turns No. 26 enamelled wire on 1"-diameter form. Winding length of 1 inch. Tap 25th turn. USE BASE CONNECTION A.
40 METERS	Same as for 80 meter coil.	22 turns No. 24 enamelled wire closewound on 1"-diameter form.	NONE
20 METERS	Same as for 80 meter coil.	12½ turns No. 24 enamelled wire on 1"-diameter form. Winding length of ¾ inch.	12½ turns No. 24 enamelled wire on 1"-diameter form. Winding length of ¾ inch. USE BASE CONNECTION B.
10 METERS	NONE	NONE	5½ turns No. 24 enamelled wire on 1"-diameter form. Winding length of ¾ inch. USE BASE CONNECTION B.

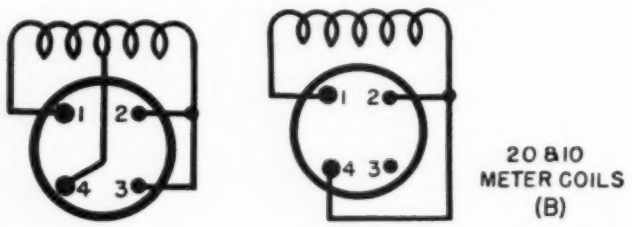


Table 1. Winding details for all coils covering the 80, 40, 20, and 10-meter bands.

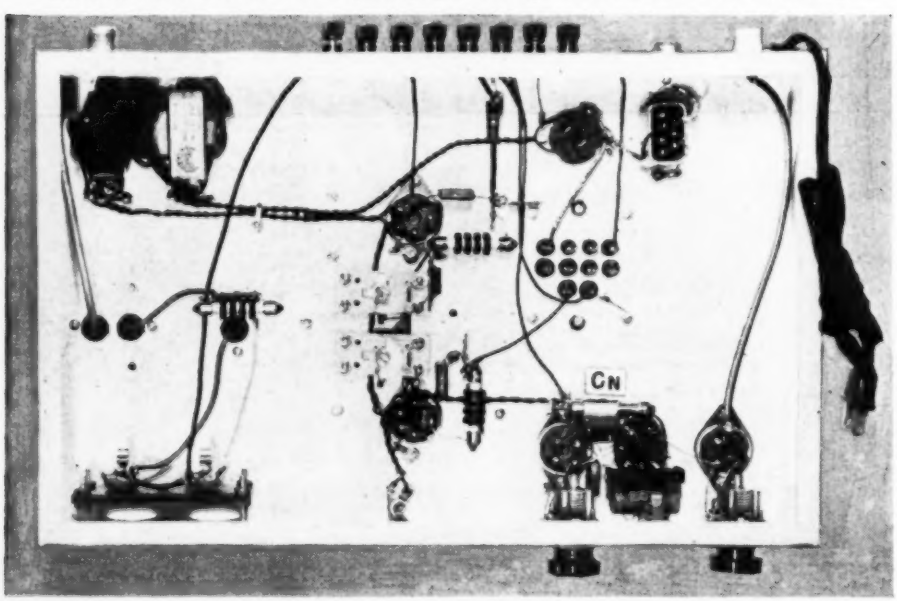
For maximum efficiency, plug-in coils have been employed throughout. The driver coils may be wound according to specifications given in Table 1 (the r.f. Driver Coil Table). The final amplifier coils are manufactured items, except in the case of the 10-meter inductance.

As will be seen from (Table 1), separate grid and plate coils are required in the 6L6 stage. These coils are not interchangeable. Each input coil (L_2) has a link input winding (L_1). The plate coils (L_3) have no link windings. The 80-meter plate coil is center tapped for neutralization. By observing the L_3 base connections given in the coil table, the neutralizing condenser will be disconnected automatically from the circuit, when the 10 and 20-meter coils are plugged in, and "B+" will be connected to bottom of the coil at the same time. For 80-meter operation, plug the 80-meter, L_1-L_2 coil into the 6L6 grid circuit and the 80-meter, L_3, coil into the plate circuit. For 20-meter operation, plug the 40-meter, L_1-L_2, coil into the 6L6 grid circuit and 20-meter L_3 coil into the plate circuit. For 10-meter operation, plug the 20-meter L_1-L_2 coil into the 6L6 grid circuit and the 10-meter L_3 coil into the plate circuit.

Mechanical and Electrical Construction

The transmitter (See Figs. 1 and 3) is built on a 17"x11"x3" metal chassis. A 5½"x7" metal baffle shield (*Bud* No. IS-1246) is mounted between the amplifier-modulator and r.f. audio driver sections.

Fig. 3. Under-chassis view showing components and wiring. Condensers C15, C17, and C18, were removed for this photograph, as they would hide much of the wiring.



The r.f. driver stage is assembled near the left-front edge of the chassis (Fig. 3). The two r.f. coils (L_1-L_2 and L_3) are wound on 1-inch phenolic forms (*National* XR-1) which plug into standard 4-prong tube sockets mounted on each side of the 6L6 tube. As will be seen from (Table 1), six of these driver coils are required to cover the 80, 20, and 10-meter bands (two 80's, one 40, two 20's, and one 10). Ceramic-insulated driver tuning condensers, C_1 and C_4, are recessed behind the front lip of the chassis so as to be as close as possible to the coil sockets.

Driver audio transformer T_2 and the 6B4-G tube are mounted to the rear of the r.f. driver stage. Audio input transformer T_1 is mounted under the chassis between the 6B4-G tube and audio input jack J_4. The latter is mounted through the rear lip of the chassis.

The two variable r.f. coupling condensers, C_6 and C_8, are mounted below the chassis with their shafts extending up through wide clearance holes between the two 807 tubes. The shafts are provided with sawed slots for screwdriver adjustment during the initial tuning-up of the rig.

The two 807 tubes are provided with external shields 2$\frac{1}{16}$" in diameter and 2¾" high. These shields are necessary for stable operation of the 807's and must not be omitted. The special shunt-feed r.f. choke (*National* R-175), RFC_2, is mounted on top of the chassis near the 807 amplifier (V_2) to which it is connected. A portion of the plate lead of the 807 modulator (V_4) is coiled (See RFC_4 in Fig. 2) to provide a parasitic suppressor choke. This coiled lead is visible in the photograph in Fig. 1.

A milliammeter jack (J_2) is connected in series with the 6L6 cathode resistor. This jack may be seen along the front lip of the chassis, in Fig. 1, between the two r.f. driver tuning knobs. Jacks J_5 and J_6 for the r.f. amplifier and modulator plates respectively are mounted on a bakelite subpanel recessed for safety behind the front lip of the chassis. Large clearance holes (1⅛" in diameter) permit insertion of the meter plug without danger of contacting the live jacks with the fingers. These clearance holes may be seen on the right-hand front end of the chassis in Fig. 1 (right). The recessed jack panel is visible in the left-hand lower portion of Fig. 3.

Coaxial cable connects r.f. input jack J_1 to the coil socket holding L_1-L_2. A similar cable connects the output tank coil link winding, L_5, to the r.f. output jack, J_3. A short length of insulated hookup wire covered with shield braid connects the primary of transformer T_1 to the audio input jack, J_4. The shield braid around this lead, as well as the outer sheath of the two coaxial lines just described, must be

(*Continued on page* 96)

WTMJ's Mobile TELEVISION UNIT

Mobile TV truck, costing $10,000, houses all equipment necessary for remote pick-ups. (Left) The rear part of the truck is a complete television control room.

Remote pickups are not simple—it takes a crew of five to ten men and two tons of equipment and cable.

By JOHN E. HUBEL

WHEN WTMJ-TV, The Milwaukee Journal station, does a remote broadcast, such as a football game far from studio transmitters, it's a speedy, efficient, though big, operation. During the weeks of trial period before going on the air on December 3, 1947, however, it was a difficult task to get the TV equipment to "location." Several trucks were used to carry the heavy units to the spot, and the programs were put on with all the attendant difficulties of gathering together and loading the TV broadcast facilities.

Now, the WTMJ-TV mobile unit is often a familiar sight; it's on the spot and on the job just as soon as anything worthwhile turns up, no matter how far from the studios. This unit, a Chevrolet truck, was ordered months ago, especially constructed for television by *RCA* at Boyertown, Pa. It cost $10,000 and weighs 9500 pounds.

To the weight of the truck, itself, is added about two tons of television equipment when taken out on location. When covering an assignment, one and one-half tons of equipment stay in the truck, and a half-ton of equipment is on cables 1000 feet long, so that it can be moved at will to the place where the pictures are to be taken. The truck has a hole in the roof on which there is a deck reached by a ladder from inside, and when necessary, television cameras can be moved to the top.

Three portable cameras may be used with this mobile unit. They are assembled before each broadcast and dismounted when it is over. The inside rear of the truck is a complete television control room, with wide panels of glass installed on three sides to permit broad vision from inside the control room. Television cameras are set up on a table stretching across the room, with three revolving seats provided for WTMJ-TV engineers. Above the table is a shelf for sound equipment, while down in front there is room for the cables to be run to the scene of the pictures.

In the central part of the truck are numerous cabinets to house equipment for amplifying as well as for television equipment not being used for the particular picture in work. There is also space for the microwave transmitter used to send the picture back to the microwave receiver at station WTMJ-TV, and space is also provided for the metering equipment used to measure the amount of electricity consumed.

Before a broadcast, the microwave transmitter must be set up on a roof or some other high point and be lined up with the microwave receiver on the tower of Radio City in Milwaukee on a line-of-sight basis. The sound portion of a television broadcast

(*Continued on page* 153)

Gordon Thomas of WTMJ-TV does an interview at the Wisconsin State Fair Park.

Build This Absorption Type SIGNAL MARKER

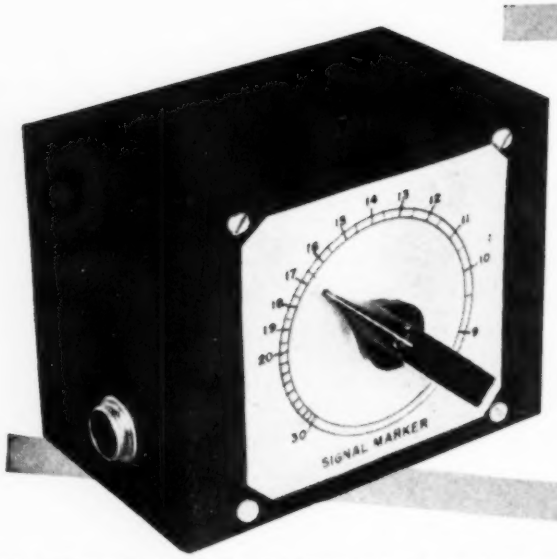


Fig. 1. External view of the completed unit. Coaxial input and output jacks are provided. The frequency dial reads from right to left in this particular unit.

By GUY DEXTER

Construction details of a simple tubeless marker device which places frequency-determined "inverted pips" on an oscilloscope alignment pattern. It is ideal for the visual alignment of AM, FM, and television receivers.

VISUAL alignment is an important time-saver in the testing of AM, FM, and television receivers. The response curves reproduced instantaneously on an oscilloscope screen in a visual alignment test would take many minutes of painstaking effort to draw by the slow point-by-point method. A number of excellent articles telling how to use frequency-modulated signals for visual alignment with an oscilloscope have appeared on these pages. For that reason, the techniques will not be reviewed here.

One difficulty of the visual alignment method, often expressed by service technicians who attempted visual alignment of AM receivers, is the inability to distinguish frequencies readily at points along the selectivity patterns. This has been overcome in modern television signal generators by means of self-contained *marker devices* which produce a frequency-calibrated pip or dip at one or more selected points on the image. However, a number of frequency-modulated signal generators and test oscillators now in use have no such provision.

An auxiliary oscillator is needed to produce an upright pip on the image. Some technicians already have used a separate oscillator for this purpose. As the second oscillator is tuned, the pip moves along the curve, and its frequency position (that is, the frequency it marks) at any point may be determined from the setting of the auxiliary oscillator with respect to the main oscillator frequency. Thus, the total width of the curve can be measured, or the frequency at any point on the curve can be determined.

An inverted pip—or more precisely, a *dip*—can be produced on the image more simply by means of an absorption circuit (nothing more than a direct-reading wavemeter) connected between the signal generator and the receiver (or stage) under test. The absorption-type marker uses no tubes and accordingly requires no power supply. The latter advantage will recommend this particular device to numerous servicemen bent on improving their present visual alignment equipment.

Any serviceman can build and calibrate an absorption-type signal marker inexpensively. The marker shown in this article cost $3.50, using all brand-new parts. An inspection of Fig. 4 will show that most of the required components can be retrieved from the junk box. The time required for the construction and calibration should not exceed a couple of hours under the worst conditions.

Signal Marker Specifications

The tuning range of the signal marker shown in the accompanying illustrations is 8.7 to 30 megacycles. This range includes the FM and television intermediate frequencies. Other frequencies may be provided by using other coil-tuning condenser combinations. For example, a 400-to-1000 kc. range might be more serviceable to the serviceman who concentrates on broadcast receivers with intermediate frequencies of 455, 456, and perhaps 465 kc.

The tuned circuit, which is the heart of the device, is comprised by the tuning condenser C_1 and coil L_1 (See Fig. 4). It will be noted that, except for a ground connection from the condenser rotors, the tuned circuit is inductively coupled to the signal generator output and receiver input. The coupling is rather loose. This arrangement affords somewhat better selectivity than is possible with an absorption circuit simply connected in series with one leg of the signal generator output, and produces a sharper dip on the oscilloscope image.

Since most signal generators now are provided with concentric-line output cables, concentric-type input and output jacks have been included in the marker. Concentric cables between the generator, marker, and receiver insure good shielding and low signal leakage. If *Amphenol* type 80-C connectors (J_1 and J_2 in Fig. 4) are employed, one matching type 80-M plug may be connected to the end of the signal generator output cable, an another to the end of the cable from the receiver-circuit input terminals. If no other variety of flexible concentric line is available, regular microphone cable may be employed in this application.

The 8.7-30-mc. coil, L_1, is wound on a ½-inch-diameter polystyrene form which, in the interest of short leads, is mounted directly on the frame of the tuning condenser. (See Fig. 5.) The *National* PRD-2 coil form used by the writer has one closed end with a central hole for a 6-32 mounting screw. This type of form is suited to the type of assembly shown in Fig. 5.

A straight-line-frequency tuning

condenser should be used, otherwise the dial scale will be too crowded at its high-frequency end to permit accurate reading. The condenser employed by the writer turns counter-clockwise to reduce capacitance. That is why the high frequencies are at the left- instead of right-hand end of the scale (See Fig. 1). A condenser with clockwise rotation will give the more conventional left-to-right scale.

The marker unit is built into a 5"x 4"x3" metal box (*I.C.A.* No. 3811). The frequency scale is drawn on a 3½"x 3½" card of white Bristol board held to the box by means of thinly spread rubber cement, and covered with a plate of transparent plastic to prevent soiling. The long finger-grip knob (*I.C.A.* No. 1155) permits close setting without a vernier.

An individual builder may follow any other preferable assembly pattern. The simplicity of the electrical part of the marker gives the builder considerable freedom in the mechanical arrangement. The marker may even be built into a signal generator if there is sufficient room.

Wiring is very simple, as Fig. 4 shows. The only care necessary in construction of the marker is to keep all leads as short as practicable. Scrape the metal sides of the box clean of all paint directly around the jack (J_1 and J_2) mounting holes to insure good electrical contact, and take up the mounting nuts of these jacks tightly. Likewise, clean the paint from around both sides of the mounting hole for the tuning condenser and mount this component tightly. The ground connection shown between the lower end of the tuned circuit and the instrument case in Fig. 4 will be made automatically by mounting the tuning condenser on the metal panel.

Calibration Procedure

After the marker unit has been assembled and its wiring verified, proceed with the frequency calibration as follows:

(1) Connect an amplitude-modulated signal generator or test oscillator, the signal marker, and a receiver capable of tuning from 8 to 30 megacycles, as shown in Fig. 2. Interrupt the a.v.c. in the receiver. It will be helpful to employ an output meter (any rectifier-type a.c. voltmeter connected across the loudspeaker voice coil will be satisfactory); but if one is not available, the speaker signal will serve as a less accurate audible indicator.

(2) Set the signal generator to 8.7 mc. and tune-in the signal on the receiver. Be sure to tune "on-the-nose," as indicated by the exact peak in the receiver output.

(3) Swing the marker tuning condenser to its maximum capacitance setting. As the marker is tuned to 8.7 mc., a reasonably sharp dip should take plaoe in the receiver output, due to the wavetrap action of the marker. If the 8.7 mc. frequency cannot be reached, carefully bend the two outside rotor plates in toward the stators

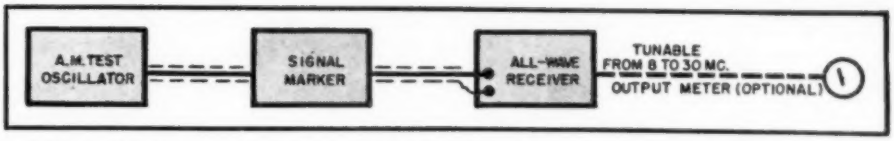


Fig. 2. Block diagram shows arrangement of miscellaneous equipment for calibrating unit.

to increase the high capacitance, until the signal is reached. When a good dip in receiver output is obtained, mark this point 8.7 on the marker dial scale.

(4) Set the signal generator to 9 mc. Tune-in the signal on the receiver and adjust the marker tuning for a sharp dip in the receiver output. Mark this point 9 on the marker dial scale.

(5) Repeat the procedure at 10, 10.5, 11, 11.5, 12, 12.5, 13, 13.5, 14, 14.5, 15, 15.5, 16, 16.5, 17, 17.5, 18, 18.5, 19, 19.5, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, and 30 megacycles. Additional intermediate points may be checked and added to the dial scale, if the operator desires.

Using the Marker

The signal marker unit may be used to identify frequency points on any image whose dimensions are within the marker tuning range. Such images include i.f., r.f., and discriminator response patterns. The marker dip may be "slid" along the curve simply by tuning the marker unit, and the position of the dip (in megacycles) may be read on the marker dial scale.

Typical selectivity images obtained with a frequency-modulated (sweep) signal generator are shown in Fig. 3. In Fig. 3A, the marker dip has been moved to the low-frequency end of the selectivity curve by tuning the marker unit. The frequency represented by this point on the curve may be read directly from the marker dial. Similarly, in Fig. 3B, the dip has been moved to the peak (center-frequency or resonant frequency) of the curve. And in Fig. 3C, the dip has been moved to the high-frequency end of the curve. With this movable dip, the operator can literally put his finger on any point anywhere on the curve and read the frequency of that point directly from the marker dial.

In use, the marker unit is connected

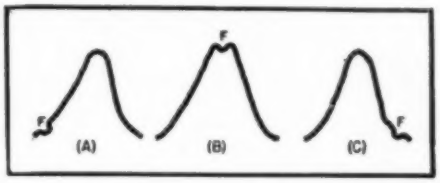
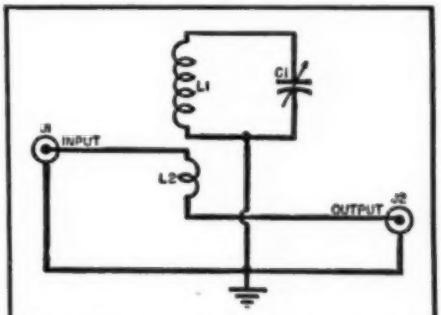


Fig. 3. Illustrating use of marker dip to determine frequencies along a typical visual alignment pattern. See text for details.



C_1—Midget 50 μμfd. var. straight-line frequency cond. (National SE-50)
J_1, J_2—Female concentric chassis receptacle (Amphenol 80-C)
L_1—19 t. #26 en. on ½" dia. form. Space to ½" winding length
L_2—1 t. solid, insulated hookup wire, spaced 1/16" from gnd. end of L_1

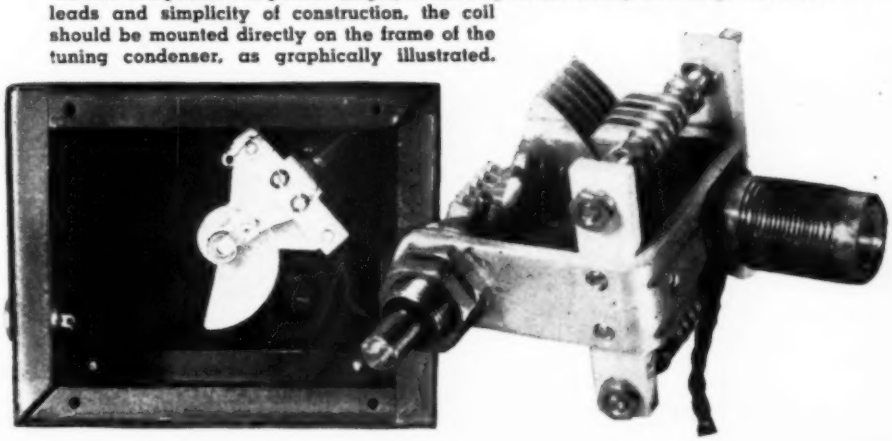
Fig. 4. Complete circuit of signal marker.

between the frequency-modulated signal generator and the receiver or receiver stage under test. The connections are similar to those shown in Fig. 2.

It is possible to construct a marker unit for frequency coverage other than that afforded by the instrument shown in this article. Either higher or lower frequency bands may be covered by using values of C_1 and L_1 other than are shown in Fig. 4. The 50-μμfd. tuning condenser will be adequate for all frequencies up to about 75 megacycles. At higher frequencies, it will be ad-

(*Continued on page* 141)

Fig. 5. (Left) Inside view of the home-built marker unit showing simple wiring and the few components required. (Right) A close-up of the tuning assembly. For short leads and simplicity of construction, the coil should be mounted directly on the frame of the tuning condenser, as graphically illustrated.



A COMPACT LOW-FREQUENCY BAFFLE

By DONALD FORT

You don't need any particular woodworking skill to construct this simple yet effective housing.

COMMERCIAL baffles with good bass response are usually quite bulky, often occupying from five to ten cubic feet. Such baffles are satisfactory when there is plenty of room, but when space is at a premium a much smaller baffle must be used. It should preferably be small enough to fit within an existing radio-phonograph cabinet, or to set on a shelf where, if necessary, the unbeautiful product of the amateur woodworker can be hidden behind a thin curtain. Such a baffle, occupying less than two cubic feet and giving a smooth bass response down to below 60 c.p.s., is described here. While it compares favorably with much larger conventional bass reflex baffles in frequency range, it is somewhat inferior in efficiency and in maximum power output at low frequencies. It is therefore advocated chiefly for home use, where economy of space is often essential and where only moderate sound levels are necessary. With all its shortcomings, however, it can still give a cheap twelve-inch speaker, driven by a ten-watt amplifier, enough woof to rattle the china.

The baffle combines the features of the acoustic labyrinth and the so-called "infinite" baffle. The usual acoustic labyrinth* consists of a folded absorbent-lined column, one end of which is coupled to the rear of the speaker, the other end being open to provide a release for back pressure. The proposed baffle differs from the usual labyrinth only in that the end of the column is *closed*. It thus resembles the infinite baffle in that the back of the speaker is completely enclosed, the front surface of the speaker diaphragm being the only sound source. The reason for this design is explained below.

The lower limits of the bass response of a baffle are set by the fundamental resonant frequency of the enclosed air mass, the response falling off rapidly below this point. For conventional bass reflex and infinite baffles the desired resonant frequency is obtained by making the volume of the speaker enclosure sufficiently large. The resonant frequency of the open-ended labyrinth depends on the length of the column, the wavelength at resonance being twice the column length. The column cross-section can be reduced sufficiently so that the bulk of the labyrinth is considerably less than that of bass reflex or infinite baffles of the same resonant frequency. There is a limit to this reduction in bulk, however, for if the column cross-section is constricted too much, very little sound can pass through the column, and back pressure will build up behind the speaker diaphragm, impeding its motion and thereby reducing the sound output. The proposed design effects a further saving in bulk, however, by cutting the column *length* in half, and *closing* the end of the column. This leaves the fundamental resonant frequency unchanged, for the wavelength at resonance is four times the column length for a closed column, as compared with twice the column length for the open column. The volume is thereby reduced to approximately half that of the conventional open-ended labyrinth with the same column cross-section and same resonant frequency.

The reduction in bulk is not accomplished without cost, however. With the open-ended labyrinth (and also the bass reflex baffle), back radiation is emitted through a separate port. With the proposed baffle, as with infinite baffles in general, sound can be emitted only through the speaker diaphragm. Thus, at resonance the back radiation travels the length of the column and is reflected back in the proper phase to reinforce the motion of the diaphragm, so that the back radiation is, in effect, emitted through the diaphragm. For a given total sound output, the amplitude of motion of the diaphragm must be greater when all the sound is coming from the diaphragm, than when part of the sound is coming from a separate port. But at large amplitudes the cone suspension system departs from linearity, resulting in harmonic distortion. Thus our baffle, in common with other infinite baffles, cannot put out as much "undistorted" sound power as can a baffle with a port for releasing back pressure. Furthermore, much of the back radiation is absorbed by the labyrinth walls. Also, the cross-section of the column is sufficiently small to offer appreciable opposition to the passage of sound, so the motion of the speaker cone is restricted somewhat. This baffle, like other labyrinth baffles, is therefore less efficient than a bass reflex baffle.

The labyrinth is lined with sound-absorbing material partly to cut down and spread out the fundamental resonant peak, and partly to damp out higher harmonics and anti-resonances. (The open labyrinth gives even harmonics, the closed labyrinth odd harmonics.) If the labyrinth walls are non-absorbent, a pronounced peak is obtained at fundamental resonance, with a series of lesser peaks and dips at higher frequencies. The latter fluctuations are not as noticeable to the ear as one might expect, however. For that reason some experimenters may find a non-absorbent baffle reasonably satisfactory.

A typical baffle design is shown in Fig. 2. The dimensions and general layout may be varied within limits to fit various sizes and shapes of speaker compartments. The volume of the baffle is slightly over 1½ cubic feet.

Design Notes

1. *Acoustic Lining.* For best results the lining should have a high absorption coefficient at middle and high frequencies, and moderately good absorption at low frequencies. Dense mats of mineral fiber, such as rock wool or glass, fiber, meet these requirements. (Do not use *thermal* insulation, as it is not nearly dense enough). It is a good idea to look at a table of the absorption characteristics of various materials for different frequencies before choosing the material. You may be impressed, as I was, with the scarcity of materials with good low-frequency absorption.

Material in the form of rigid sheets is the easiest to work with, since it supports itself and can therefore be used by itself to form the baffle plates.

*Olney: Journal Acoustical Society of America, Vol. 8, No. 2, 1936, page 104.

I used *Johns-Manville* "Airacoustic" sheets, one inch thick (rigid sheets for lining air-conditioning ducts). Thinner sheets are available, but the thicker ones have better low-frequency absorption as well as greater mechanical strength. Sheets of glass fiber or other material with similar properties should work just as well. The sheets are used both to line all surfaces of the speaker compartment and to form the interior baffle plates.

The baffle plates should preferably be mounted vertically as shown, as this simplifies the problem of keeping them in place. If they are cut for a tight fit, they will stay in place without being fastened, unless the cabinet is tipped over. If necessary they may be pegged securely in place with a few finishing nails, as shown in Fig. 1C.

2. *Column Dimensions.* The effective length of the baffle shown here is over 5 feet, which means a resonant wavelength of over 20 feet, or a resonant frequency somewhat below 60 c.p.s. The choice of resonant frequency depends on the type of over-all response desired, and on the characteristics of the other audio components, in particular the resonant frequency of the speaker. It is very easy to experiment with different column lengths by varying the number or arrangements of baffle plates until the desired response is obtained.

The baffle shown is believed to be about as small as is practicable. Since the acoustic material takes up a sizable fraction of the total volume, any further reduction in bulk would necessitate a relatively great decline in the air space. This would mean a substantial reduction in either column length or cross-section, at the expense of performance. By the same reasoning, it is advisable to make the baffle larger than shown, if space permits. This baffle, however, seems to be a reasonably satisfactory compromise between performance and compactness.

The front baffle plate has a hole which fits snugly over the speaker field housing, permitting the plate to be mounted close to the front of the speaker. This is necessary to provide proper coupling between the speaker and the column. If the arrangement of Fig. 1B were used instead, the coupling would be very poor because of the great contrast between the cross-section of the column and that of the chamber immediately surrounding the speaker. Most of the back radiation would be trapped in the latter chamber, setting up a resonance, not adequately damped by the lining, resulting in a very annoying peak in the middle voice frequencies.

3. *Speaker.* In the open-ended labyrinth and bass reflex baffles much of the low-frequency output comes from the port rather than directly from the speaker diaphragm. It is thus possible to obtain satisfactory bass response using a relatively small diameter speaker. With our baffle, however, as with all types of infinite baffles, it is essential to use a large speaker, since

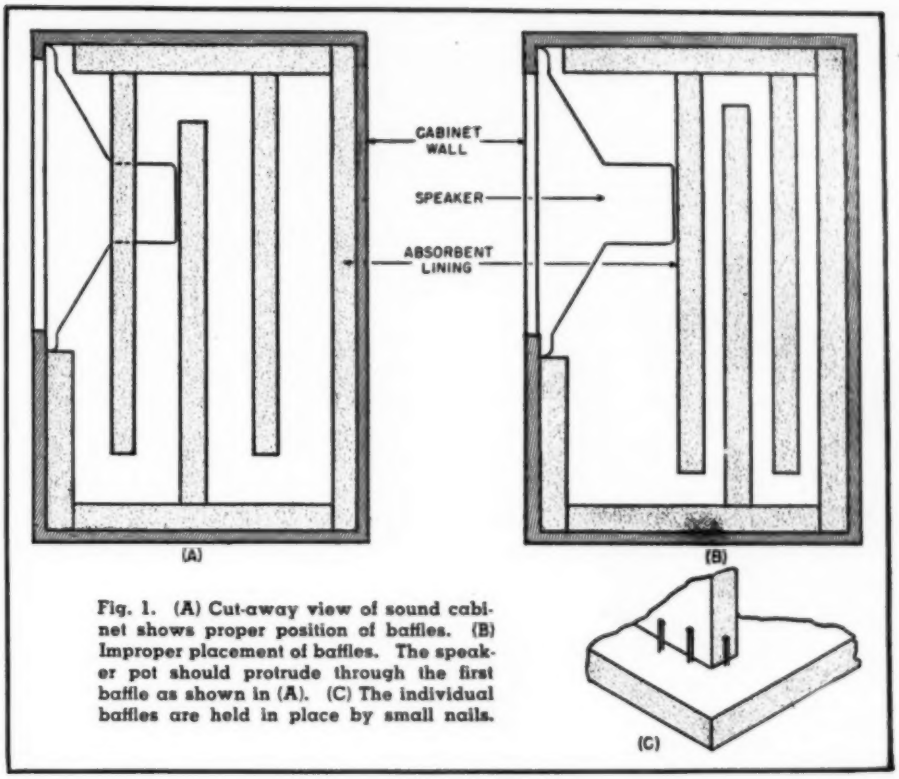


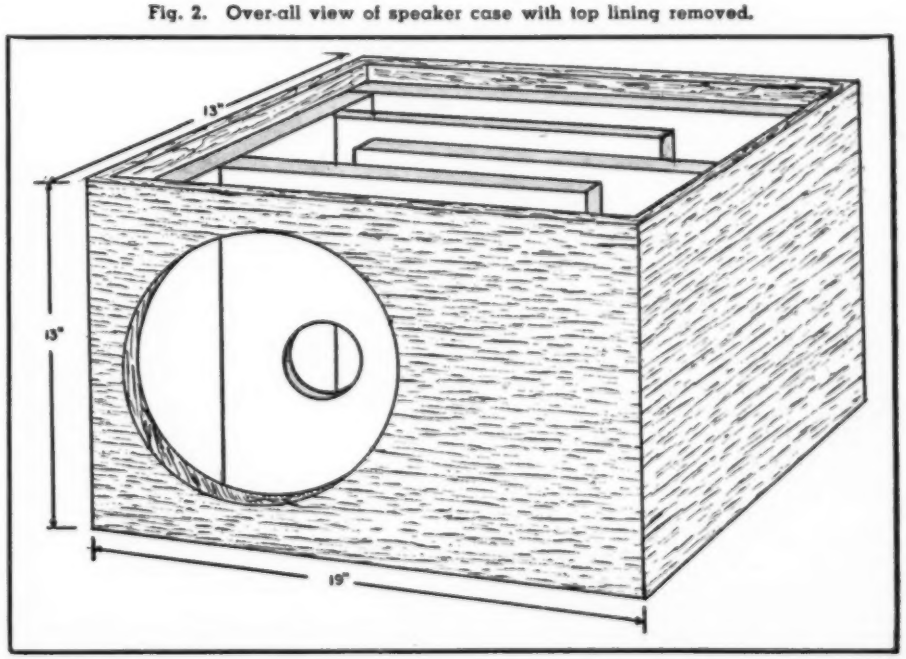
Fig. 1. (A) Cut-away view of sound cabinet shows proper position of baffles. (B) Improper placement of baffles. The speaker pot should protrude through the first baffle as shown in (A). (C) The individual baffles are held in place by small nails.

the front of the speaker diaphragm is the only sound source. A six or eight-inch speaker is entirely unsatisfactory for this type of baffle. A twelve-inch speaker will do, and a fifteen-inch speaker is still better. The larger speaker is superior in having a lower resonant frequency as a rule, but the chief advantage is in the greater maximum undistorted sound output at low frequencies. This is particularly important, for high power output is most needed at low frequencies.

The marked dependence of bass response upon speaker size is evident from the theoretical equations of speaker performance. Assuming the cone to move as a piston, the sound power output at a given frequency is proportional to the area of the cone, the radiation resistance per-unit-area, and the square of amplitude of vibration of the cone. But the area of the cone varies as the square of its diameter, and so does the radiation resistance per-unit-area, at low frequencies. And the maximum excursion the cone can make, without excessive distortion due to non-linearity of the suspension system, is presumably roughly proportional to the cone diameter. For there is usually a rough correlation between the dimen-

(*Continued on page* 112)

Fig. 2. Over-all view of speaker case with top lining removed.



The Beginning Amateur

Neat and inexpensive, this receiver transmitter combination is ideal for the beginner. In spite of its simplicity, excellent long-distance communication can be enjoyed with it.

By
ROBERT HERTZBERG,
W2DJJ

Part. 5. You're on the air—if you've followed this series you should have your ham license and receiver—here are the construction details for your transmitter.

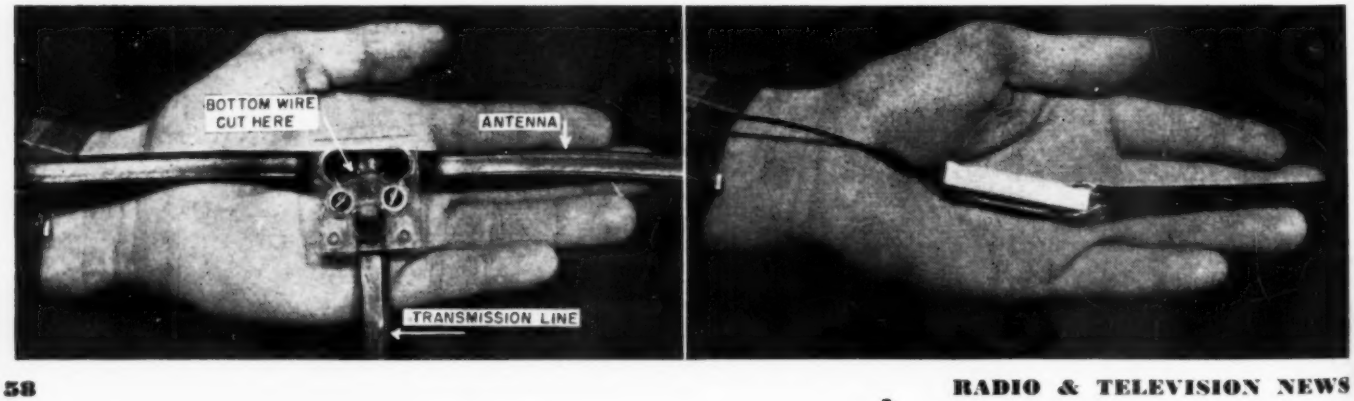
YOU now have a ham license, a receiver (described in the April, 1949 issue of RADIO & TELEVISION NEWS), and a burning desire to go on the air. Where do you start? How much, or rather how little, must you spend for a transmitter?

You'll be rather surprised to learn, right off, that a basic c.w. transmitter is simpler in design and construction than a receiver. The foolproof rig pictured herewith can easily be assembled in about three or four hours, at a cost of $20 to $25. The parts, with the exception of the main tuning coil, L_1, are standard receiving-type components and can be bought at bargain prices. If you start the project in the morning and allow yourself an hour or so after lunch for the antenna installation, you will be pounding brass by supper time. The likelihood is that you'll forget all about supper when some other ham answers your first *CQ*!

The transmitter was designed as a companion unit for the receiver, and uses a chassis and a front panel of the same dimensions. If you have access to a manual training shop in school, or have the necessary woodworking tools at home, you can dress up the outfit considerably by enclosing both receiver and transmitter in a simple cabinet. Provide a hinged top for the receiver so that you can change plug-in coils readily.

Note that this is a c.w., not a phone transmitter. Sure, you'll go on phone eventually, but you need preliminary experience in tuning procedures, the handling of radio-frequency energy, etc., and a c.w. rig gives it to you painlessly and inexpensively. Phone is fun, but also a bit more costly. Check the cost of microphones, speech amplifiers, and modulation transformers, and you'll agree that c.w. is a smart beginning for your ham career;

(Left) The photograph shows how the transmission line joins the center of the antenna. One wire of the antenna is cut, and the two ends thus formed go to the ends of the transmission line, under the heads of machine screws. (Right) The free ends of the antenna are joined and soldered where they pass through one hole of the insulator.



and when you discover how readily you can work DX with low power, you'll appreciate c.w.'s long-standing popularity with hams the world over.

The transmitter uses one tube, a 6L6, as an oscillator, or generator of radio-frequency energy, and a second, a 5Y3, as a high-voltage rectifier to supply direct current to the plate of the 6L6. The actual radiating of the radio signals into space is done by an antenna of the popular "folded dipole" type, made of inexpensive twin lead wire. This is the same stuff used for television aerial lead-ins. There is only one tuning control, and once you set it for a particular frequency you leave it alone.

After you look over the diagram of the transmitter, the parts list, and the construction photographs, you'll probably remark, "Heck, there's nothing to this." Study the layout carefully before you drill any holes. It has been worked out to produce short, direct connections, which are helpful in any short-wave transmitter. No detailed layout drawings are given because parts vary in dimensions, but follow the *general* plan and you'll experience no difficulty.

On the chassis proper are mounted the power transformer, T_1, and its associated rectifier tube, V_2, and filter condensers, C_5 and C_6; the sockets for the oscillator tube, V_1, the crystal, and the plug-in coil, L_1. The front panel holds only the tuning condenser, C_4, the line switch, S_1, and the panel light, PL_1.

Because the tuning condenser, C_4, is part of the high-voltage supply circuit, it must be insulated completely from the panel. Mount it on a piece of bakelite, fiber, or even well dried hard wood measuring about 1 x 3 inches. Drill a center hole in the panel large enough to clear the condenser mounting stud and nut by about ⅛ inch, and fasten the insulating strip to the panel, from the back, by a couple of short 6-32 screws and nuts. Fit the protruding shaft, on the front side, with a bakelite pointer knob. Make a simple dial from white paper and attach it to the panel by means of rubber cement, airplane dope or *Scotch* tape.

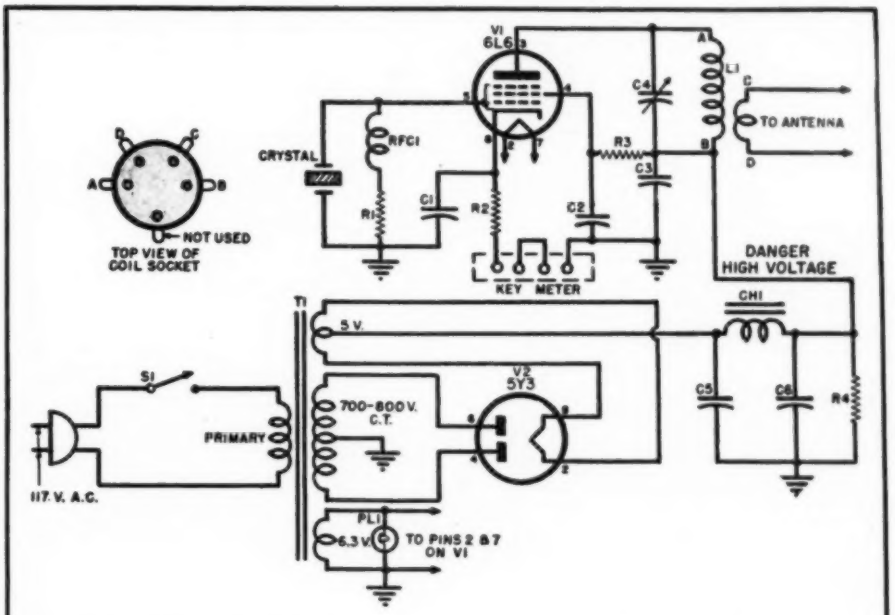
The sockets for V_1 and L_1 are raised above the top surface of the chassis by brass or fiber spacers, or piles of washers, to a height of about ½ inch. This arrangement keeps the high-voltage leads in the open air and reduces the possibility of flashovers to the grounded chassis. The crystal socket sits flush against the chassis. Only two of the five pins of this socket are used to take the prongs of the crystal holder.

The underside of the chassis holds the filter choke, CH_1, and the few small resistors and condensers. The wiring is very simple and shouldn't take you more than thirty minutes.

Connections for the key and a plate circuit milliammeter are made at a four-terminal strip on the back of the chassis. Space this away from the metal surface by collars, to give access to the soldering lugs.

I strongly recommend that you go on the air initially on the so-called 40-meter band. This extends from 7000 to 7300 kilocycles (7 to 7.3 megacycles), is devoted exclusively to c.w., permits wonderful DX contacts, and requires only a simple antenna. Surplus Army and Navy crystals for this range are available by the thousands, at give-away prices. To play safe, keep away from the extreme edges of the band. *Any* frequency higher than 7000 and lower than 7300 is satisfactory. I selected a crystal cut for 7150 kilocycles because it can be used later to control a phone transmitter on 28.6 megacycles, in the 10-meter phone band. (For this purpose, the circuits are arranged to quadruple the crystal frequency: 7150 times 4 equals 28,600 kilocycles, or 28.6 megacycles.) Used

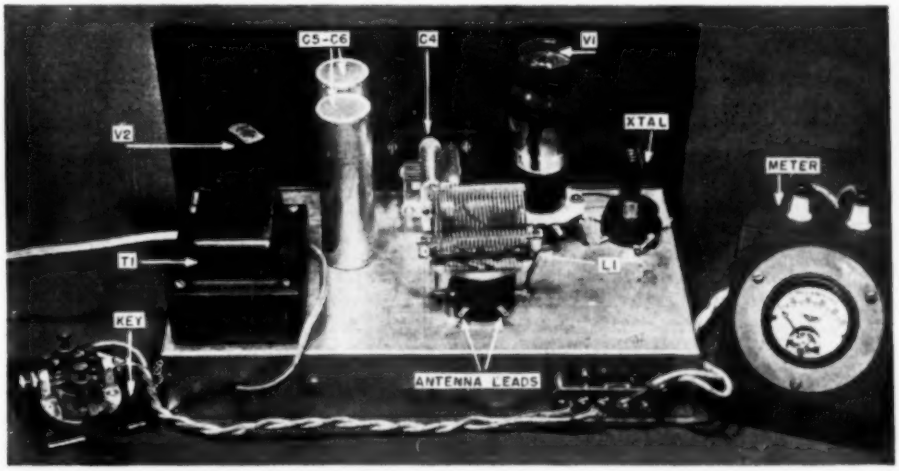
(*Continued on page* 142)



R_1—20,000 ohm, 1 w. (or 22,000 ohm) res.
R_2—200 ohm, 2 w. (or 220 ohm) res.
R_3—15,000 ohm, 2 w. res.
R_4—25,000 ohm, 20 or 25 w. wirewound res.
C_1—.01 μfd., 400 v. cond.
C_2, C_3—.01 μfd., 600 v. mica or paper cond.
C_4—50 μμfd. double-spaced midget var. cond.
C_5, C_6—8 μfd., 600 v. elec. cond.
CH_1—10 hy. 150-175 ma. filter choke
RFC_1—2.5 mhy. r.f. choke
S_1—S.p.s.t. toggle sw.
T_1—Power trans. 700-800 v. center-tapped, 125-150 ma., 5 v. @ 2 amp., 6.3 v. @ 2 amp.
L_1—Plug-in tank coil for 40 meters (Barker & Williamson Type 40JEL)
PL_1—Panel light, 6.3 v.
V_1—6L6 or 6L6G tube
V_2—5Y3 tube
Crystal—Quartz crystal, any frequency between 7.0 and 7.3 meg.
Miscellaneous parts
Chassis, alum. or zinc plated steel: 7"x13"x2"
Panel, alum. or zinc plated steel: 7"x14"x⅛"
Sockets. One octal saddle or wafer type for V_2; one octal molded bakelite top-of-chassis mounting type for V_1; two five-prong molded bakelite top-of-chassis mounting type for crystal and L_1
Pointer knob for C_4
Four-screw terminal strip
Line cord and plug, and soft rubber grommet
Telegraph key, from previously-built code practice set
Milliammeter, d.c. type—scale range 0 to 150 or 0 to 200 ma.
Antenna, top section, 65 feet of 300 ohm twin lead; transmission line section to suit location
Dipole connector block
Two small aerial insulators, glass or ceramic

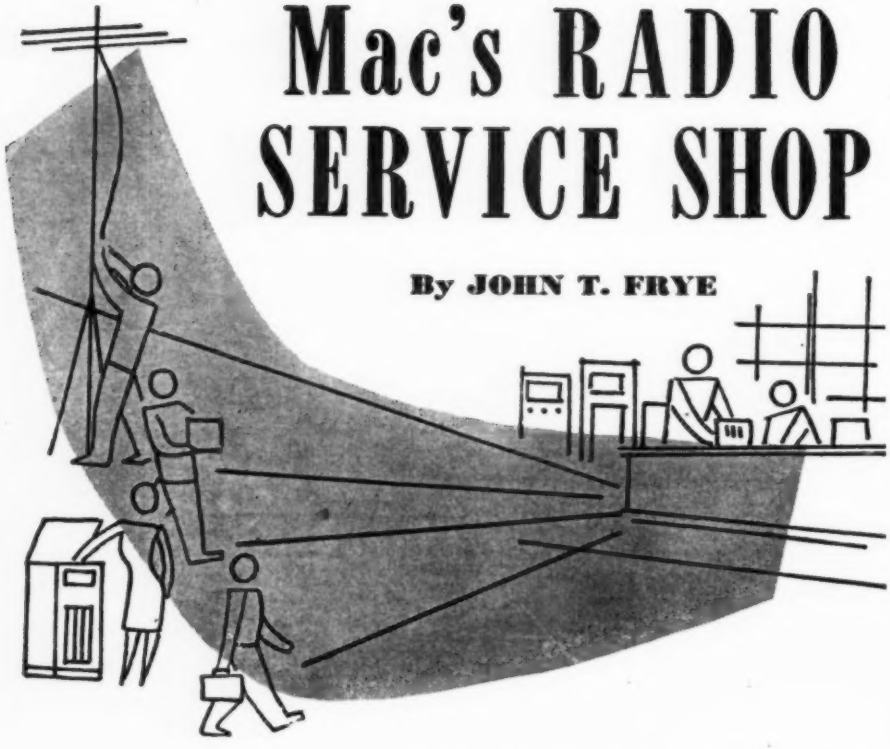
Complete schematic diagram of transmitter. Only two tubes are required.

The complete amateur transmitting station: key is on the left, the transmitter is in the center, and the plate meter is on the right.



Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



BARNEY AND THE BOOSTERS

AFTER having had that young Irishman, Barney, as an assistant in his radio service shop for over a year, Mac thought he was pretty well prepared for anything the boy might do; but he was still somewhat taken aback when one bright June day the lad came dashing and sliding into the service department after his lunch hour, yelling at the top of his voice, "Your-a-kay! Your-a-kay!"

Instantly Mac grabbed up the atomizer-bottle of cleaning fluid used to brighten up dial glasses and squirted a couple of shots at Barney's fiery red hair.

"Calm down! Calm down!" he ordered. "And what's this 'your-a-kay' business?"

"You know: 'your-a-kay,'" Barney said impatiently. "It is what Archimedes said when he discovered the law of flotation. It's Greek and means 'I have found it.'"

"I always thought the word was pronounced 'Eureka,'" Mac said mildly; "but what particular 'it' have you found this time?"

"I've just solved the problem of how to get good TV reception in the fringe areas," Barney announced importantly.

"I *told* you not to run around in this hot sun without your hat on," Mac muttered, "but tell me more! I, and about fifty million other Americans, are strangely interested."

"Like all great inventions, it is really quite simple," Barney said modestly. "You know that an airplane flying overhead reflects a signal down to the set; right?"

"Check."

"My idea is simply to paint the outside of a spherical balloon with metallic paint, so that it will reflect TV waves and then to send it up a thousand feet or so on the side of town farthest from the TV station. Because of the spherical shape, it will reflect the signals passing high overhead down into every part of the town, and there will always be some point on its curved surface that will reflect the signal to a given spot, no matter how much the balloon turns or bobs around."

"Perhaps if you were to lie down there on the bench for a while and if I were to place cool, moist compresses on your head," Mac mused, "or maybe squeeze your head just a little bit in the vise—?"

"All right! All right! They laughed at Marconi, too," Barney said: "but I am going to try it all the same—just as soon as I can get hold of a suitable balloon."

"What brought on this unusual attack of deep thinking?" Mac asked curiously.

"The gang over at the hash-house was arguing about fringe-reception in general and boosters in particular. Some said boosters were next to worthless; others swore by them. How do you feel about boosters?"

"Well, that's a good bit like asking what *you* think about blondes. In both cases the answer might well be: 'There are lots of different kinds, and even the same kind behaves differently in different situations.'"

"Is that why there is so much disagreement about blondes—I mean boosters?"

"I think so. One thing you have to remember is that the booster has to have something to boost. Unless the antenna can deliver some sort of signal to it, it has nothing to work on. The results are about the same as when a small boy reaches the bottom of his soda. He keeps on trying, but about all his straw delivers is noise.

"And speaking of noise," Mac went on, "the important thing to a booster is not how much signal you have, but how much signal you have in comparison with the noise level. In a very quiet location, the booster can take a noise-free signal of only a few microvolts and push it up to where it will make a good picture. In another location where a much stronger signal is available but where it is accompanied by an equally-strong noise, the booster is helpless, for it cannot boost the one and not the other. In the latter case, the owner of the TV set could truthfully say that a booster did not help him, for the gain of his unaided receiver would be sufficient to reach down to his high noise level."

"What could he do about it?"

"Well, he would have to make changes in the kind, orientation, or location of his antenna, or in the type or path of his lead-in so as to produce a more favorable signal-to-noise ratio. He could do this by increasing the signal strength, decreasing the noise, or by raising or lowering both, non-uniformly, so that the signal has the better of it. Once he has that signal sticking up out of the noise level, the booster can take hold of it and raise it to picture-making strength."

"In other words, if the signal in your antenna is well above your noise level, the booster can do a good job on it; if not, the thing to do is not to cuss the booster but to work on the antenna."

"Go to the head of the class, Junior."

"What does it take to make a good booster?"

"The perfect booster," Mac said slowly, "would be one that would amplify uniformly the full six megacycle width of each of the twelve channels and nothing else. It would contribute no noise of its own, would be completely stable, would not upset the impedance of the leadin into which it was inserted, and would have high amplification."

"How close can we come to that?"

"Not too close. Tight coupling to the antenna and resistor loading of the tuned circuits flatten out the response curve but only at the expense of gain; and we still cannot achieve the straight-sided flat-topped response curve we'd like. What's more, every booster contributes some noise of its own to that picked up by the antenna, and it is difficult to achieve both high gain and low noise."

"What does too narrow a bandpass do?"

"Shows up as a lack of detail in the picture or, in the case of a weak signal, difficulty in getting both the picture and the sound at the same time. By tuning the narrowband booster, you can peak up one or the other, but not both." (*Continued on page* 140)

A Miniature Phone-C.W. Transmitter for Portable or Mobile Use

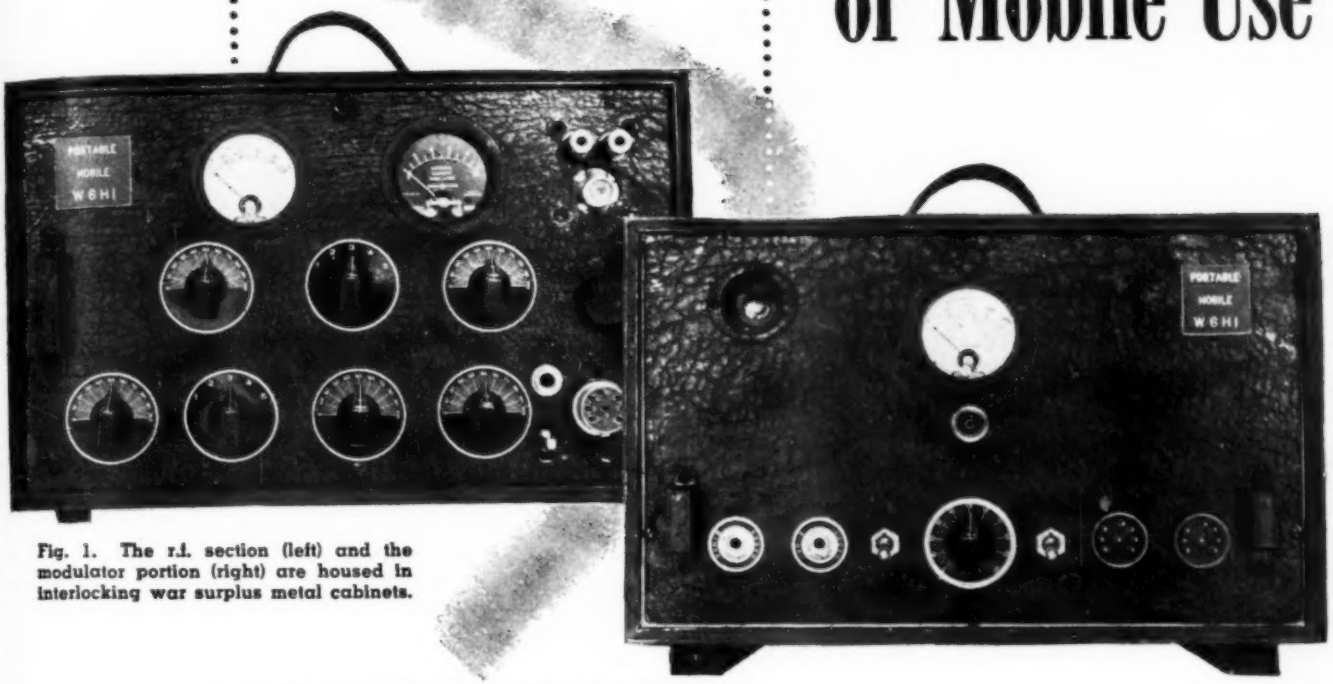


Fig. 1. The r.f. section (left) and the modulator portion (right) are housed in interlocking war surplus metal cabinets.

By HAL BUMBAUGH, W6HI

A deluxe type portable or mobile transmitter which offers all of the desirable features of a home rig.

THE design of small transmitters for portable or mobile use resolves itself usually into a struggle for simplification and compactness. While, in general, these are definitely necessary requisites they are all too frequently obtained at the cost of power output, stability, and completeness of control.

If there is one type of transmitter in which every fraction of a watt should be conserved within the transmitter and every possible watt obtained at the output it is the small portable or mobile job.

It is the purpose of this article to describe a transmitter in which every feature to be found in the home shack kilowatt rig is retained, one which has adequate output for DX work on phone or c. w. on all amateur bands, and yet can be comfortably housed in a small metal carrying case.

All-band operation can be had on either phone or c. w. with only three crystals in the 80 meter region, and the rig may be powered either with a 6 volt battery, a 12 volt battery, or a conventional a. c. power pack.

Use is made of presently available items on the surplus market which permit the building of a complete transmitter at a very reasonable cash outlay.

The two principal items entering into such a design are, first, tubes, and second, power supply.

The power tube used in the final stage of the transmitter and in the output stage of the modulator is the 815. This is a tube which is one of the best dollars-and-cents buys available to the amateur but one whose watts-per-dollar value is, unfortunately, little recognized by amateurs. The general design of the tube is such that it lends itself well to external short leads and compact construction. It is a double beam tube built into a short, sturdy glass envelope and requires extremely low grid driving power—either r. f. or a. f.—for full power output. Its construction also makes it ideal for push-pull operation where the length of the external leads may be brought down to the irreducible minimum, thus making for extremely high efficiency and stability. For example the grid leads in the rig to be described are one inch in length while the plate leads are one half inch long.

The other half of the team is a PE 103 dynamotor of the type which gave such excellent service during the last war and which is now available on the surplus market at an extremely low figure. One of these new dynamotors should take care of all future mobile problems—as well as some portable ones—for the amateur for some years to come. They are very ruggedly built and will deliver several times their rated output without damage. Furthermore they can very readily be adapted to amateur use as will be seen later.

The surplus market is again called on to provide a carrying case for the transmitter and the modulator. These cases were used by *Collins* to house their small communications units known as the MBF. These aluminum cabinets, with carrying straps and lock-on lids, are available at a very reasonable figure and come in pairs which lock together, thus making an ideal set-up for housing the transmitter and modulator to be described. The individual cases measure 14 inches by 9 inches by 8 inches. If these cases cannot be obtained, commercial cabinets approximating these dimensions may be used.

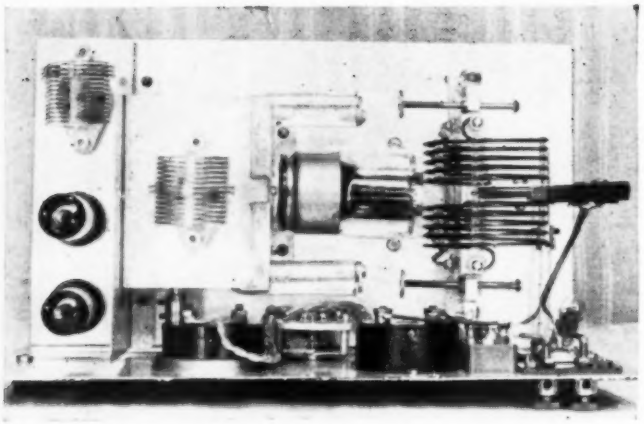


Fig. 2. Top chassis view of r.f. portion. Neutralizing condensers, C_{11}, C_{18}, may be seen at ends of tank coil, L_6, L_7.

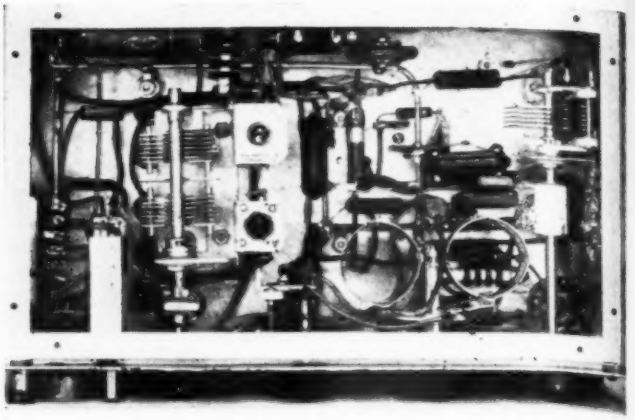


Fig. 3. Bottom view of unit. The two toggle switches near center of chassis are phone-c.w. and microphone supply switch.

Standard commercial chassis measuring 12 inches by 7 inches by 3 inches are just right for these cases as can be seen in the photographs.

Front panels may be of any desired metal and thickness to suit the constructor as they will be finished in black crackle lacquer when completed. Panel dimensions are 13¼ inches by 8⅛ inches.

Transmitter

Fig. 4 is the circuit diagram of the r. f. section.

While a great deal of latitude is permitted the designer in the choice of oscillator circuits it is the author's belief that the circuit shown is probably the best all-around circuit since it is easily set up, never fails to start regardless of the load, can work straight-through with no possible damage to the crystal, and has extremely high harmonic output up to the fourth harmonic. There are no adjustments other than that of the load circuit tank. As will be seen, the circuit is inherently a Colpitts with the voltages apportioned by the condensers in the grid circuit. The load is electron coupled for the fundamental or any of its harmonics.

While almost any of the conventional tubes used as oscillators may be used in this circuit, the 6AG7 (basically a television video tube) is the best because of its extremely small interelectrode capacities and its excellent inherent shielding which is an aid in holding crystal current to a minimum and protecting the oscillator from reflected changes in the output or load circuit.

For the above reasons another 6AG7 was chosen to function as a buffer-doubler tube since it functions equally well for this purpose, the doubling efficiency being very high.

As a load circuit for the 6AG7 oscillator and a coupling medium to the 6AG7 buffer-doubler a *Barker & Williamson* 2-A "Band-Hopper" coil was chosen and can be seen in Fig. 3. Its taps are available through the medium of the switch built into the assembly, the shaft of which extends through the front panel, and it is the second control from the left in the lower row in Fig. 1.

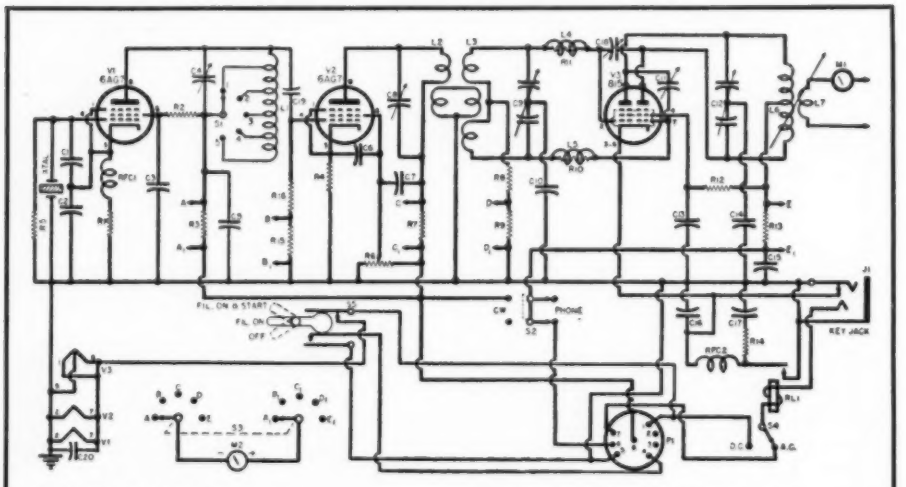
The load circuit L_2 of the 6AG7 buffer-doubler is a plug-in "Baby Type" *Barker & Williamson* coil with end link (type MEL). It is tuned by a 100 $\mu\mu$fd. condenser, C_8.

A very important feature of the buffer-doubler stage is the 50,000 ohm potentiometer, R_6, which functions as an excitation control for the final. Not until one has had experience with such a control is it realized what extended voltage excursions of screen and plate voltage are required to maintain rated grid milliamperes in the final stage under conditions of doubling or buffer action in the second stage. From the standpoint of maintaining optimum conditions and efficiency in the transmitter, this is probably the most important single control.

A very short section of 72 ohm flat line connects the link on the buffer-doubler coil with the center link on another "Baby" *Barker & Williamson* coil, L_3, in the grid circuit of the final (type MCL). To avoid unwanted coupling this link is grounded thus restricting the coupling to magnetic only.

The grid circuit of the final is tuned with a two-section 100-100 $\mu\mu$fd. condenser, C_9, positioned directly under the grid coil and adjacent to the base pins of the 815 thus making for short leads. As a matter of fact the one inch grid leads are really made up of 10 ohm resistors R_{10}, R_{11} with 7 turns of #20 tinned wire wrapped around them to form the parasitic suppressors L_4 and L_5, and are completely effective

Fig. 4. Circuit diagram of the r.f. portion of the portable-mobile transmitter.

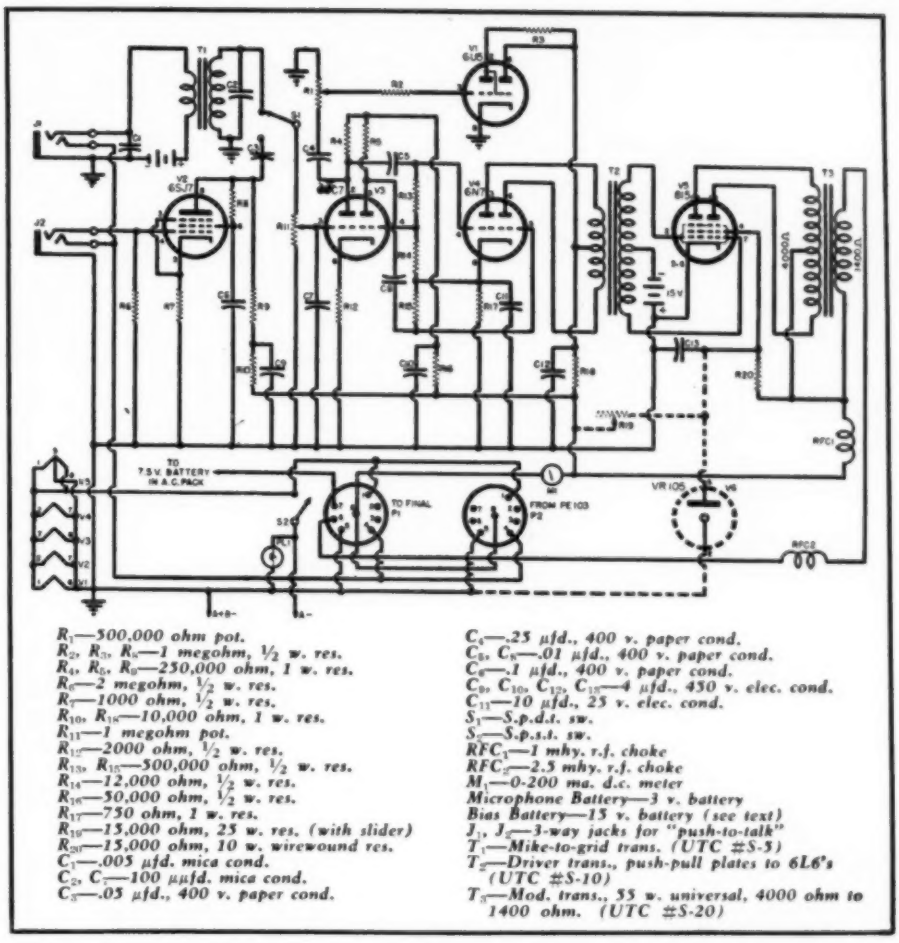


R_1, R_4—500 ohm, 1 w. res.
R_2, R_{16}—50,000 ohm, 1 w. res.
R_3, R_7—25 ohm, ½ w. res.
R_5—75,000 ohm, ½ w. res.
R_6—50,000 ohm pot. (final excitation)
R_8—15,000 ohm, 1 w. res.
R_{9}, R_{10}—200 ohm, ½ w. res.
R_{10}, R_{11}—See text
R_{12}—10,000 ohm, 10 w. wirewound res.
R_{13}—Shunt to make meter read 200 ma. full-scale (see text)
R_{14}—350 ohm, ½ w. res.
C_1—15 $\mu\mu$fd. ceramic cond.
C_2—50 $\mu\mu$fd. ceramic cond.
C_3, C_{13}, C_{15}, C_{20}—.002 μfd. mica cond.
C_4—30 $\mu\mu$fd. var. cond.
C_5, C_7, C_{10}, C_{11}, C_{19}—.005 μfd. mica cond.
C_6—.01 μfd. mica cond.
C_8—100 $\mu\mu$fd. var. cond.
C_9, C_{12}—100/100 $\mu\mu$fd. dual var. cond.
C_{11}, C_{18}—Neutralizing cond. (see text)
C_{16}, C_{17}—.5 μfd., 400 v. paper cond.
S_1—Switch on "Band-Hopper"
S_2—D.p.d.t. toggle sw.
S_3—D.p. 5-pos. rotary sw.
S_4—S.p.d.t. toggle sw.
S_5—Special sw. (see text)
RFC_1, RFC_2—2.5 mhy. r.f. choke
L_1—Barker & Williamson #2-A "Band-Hopper"
L_2—Barker & Williamson #MEL
L_3—Barker & Williamson #MCL
L_4, L_5—See text
L_6, L_7—Barker & Williamson #BVL
M_1—Ant. current indicator (G.E. Type DW52 (surplus) see text)
M_2—50 ma. d.c. meter
RL_1—6 v. keying relay
J_1—Keying jack
V_1—6AG7 osc. tube
V_2—6AG7 buffer-doubler tube
V_3—815 tube
1—Crystal

since no parasitics exist in the rig.

The output circuit of the 815 is the conventional push-pull set-up tuned by a 100-100 μμfd. split-stator condenser, C_{12}, while the coils used are larger *Barker & Williamson* "Air Inductor" type equipped for swinging link (Type BVL). The shaft on which the swinging link is positioned is carried through the front panel and controlled by a knob mounted near the right hand end of the panel. The adjustment of this link is very important in getting optimum performance out of the transmitter, especially on phone where the loading must be adjusted to provide the proper impedance match for the secondary of the modulation transformer. The pickup coil of the link is connected through a few inches of 72 ohm flat line to a small *G. E.* antenna current meter and associated rectifier (Type DW 52) which is available on the surplus market. This meter has a full scale reading of .75 amp. and the scale is divided into ten parts. Many small r.f. meters of similar type are available on the surplus market. From the meter the leads then go to a pair of binding posts on the front panel. In parallel with these posts is a coaxial fitting which permits connection to the antenna through the medium of flat lines, twisted pairs, or coaxial cable.

Since the small job was to have the same metering facilities as the largest rig—and had only one meter—a metering switch was indicated and this was connected as shown on the wiring diagram. In view of the fact that in the five circuits to be metered the lowest reading was to be about five milliamperes and the highest (in the final plate circuit only) about 150 milliamperes—the others being intermediate—a 0-50 milliampere *Weston* Model 506 meter was chosen. Thus it will read all circuits directly with the exception of the 815 final plate circuit. For this circuit a piece of nichrome wire from an old resistor was put across the meter terminals (with the meter reading full scale from a battery and potentiometer) and shortened until the meter read ¼ full scale. This shunt was then applied to the plate resistor R_{21} in the transmitter diagram. Thus the final plate current is four times the milliampere reading on the meter.



R_1—300,000 ohm pot.
R_2, R_3, R_4—1 megohm, ½ w. res.
R_5, R_6, R_9—250,000 ohm, 1 w. res.
R_7—2 megohm, ½ w. res.
R_8—1000 ohm, ½ w. res.
R_{10}, R_{18}—10,000 ohm, 1 w. res.
R_{11}—1 megohm pot.
R_{12}—2000 ohm, ½ w. res.
R_{13}, R_{15}—500,000 ohm, ½ w. res.
R_{14}—12,000 ohm, ½ w. res.
R_{16}—50,000 ohm, ½ w. res.
R_{17}—750 ohm, 1 w. res.
R_{19}—15,000 ohm, 25 w. res. (with slider)
R_{20}—15,000 ohm, 10 w. wirewound res.
C_1—.005 μfd. mica cond.
C_2, C_7—100 μμfd. mica cond.
C_3—.05 μfd., 400 v. paper cond.
C_4—.25 μfd., 400 v. paper cond.
C_5, C_8—.01 μfd., 400 v. paper cond.
C_6—.1 μfd., 400 v. paper cond.
C_9, C_{10}, C_{12}, C_{15}—4 μfd., 450 v. elec. cond.
C_{11}—10 μfd., 25 v. elec. cond.
S_1—S.p.d.t. sw.
S_2—S.p.s.t. sw.
RFC_1—1 mhy. r.f. choke
RFC_2—2.5 mhy. r.f. choke
M_1—0-200 ma. d.c. meter
Microphone Battery—3 v. battery
Bias Battery—15 v. battery (see text)
J_1, J_2—3-way jacks for "push-to-talk"
T_1—Mike-to-grid trans. (UTC #S-5)
T_2—Driver trans., push-pull plates to 6L6's (UTC #S-10)
T_3—Mod. trans., 55 w. universal, 4000 ohm to 1400 ohm. (UTC #S-20)

Fig. 5. Schematic diagram of the audio and modulator portion of the transmitter.

While the 815 may be used for some purposes and under some conditions without neutralization complete mastery of the circuit could be obtained only if there was complete and stable neutralization under all conditions. Hence the small neutralization set-up, consisting of C_{11}, C_{18}, as shown in Fig. 2 was installed. The grid circuit is "crossed over" and the leads brought out along polystyrene stand-offs as shown. The dimensions of the end plates on these leads are approximately ⅝" by ⅜" with rounded corners and edges. The other plates of the condenser are ⅜" diameter washers soldered on the end of 8-32 brass screws 3" long. Adjustment is made by screwing the assembly in or out. While the spacing will depend on the mechanical and electrical set-up adopted by the individual constructor the spacing used in this case is 13/16 inches. This was the setting obtained for the ten meter band and will serve for all lower frequency bands. The final neutralizes easily and is perfectly stable with this arrangement.

In Fig. 2, just over the shaft extension for the swinging link, is shown a

Fig. 6. Bottom view of the audio section. The battery for "C" bias may be seen at the upper left hand corner of the chassis.

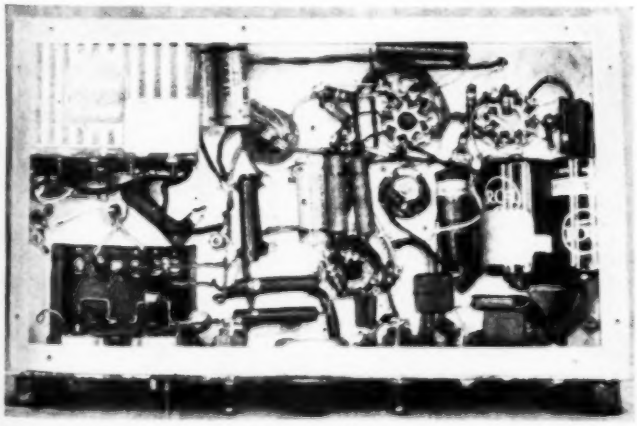
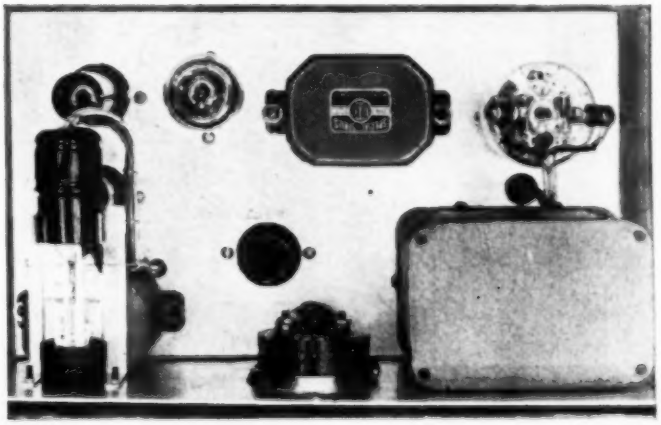


Fig. 7. Top view of the audio chassis. The 6U5 tube used for modulation indication may be seen at the lower left of photo.



Band	Xtal. No.	Sw. S_1	Buffer or Doubler	Excitation R_6	Xtal. Tune C_1	Buff.-Doub. Tune, C_5	Final Grid Tune, C_9	Final Plate Tune, C_{12}	Freq. (kc.)
80 c.w.	1	5	B	15	50	48	63	70	3,525
80 ph.	3	5	B	15	49	55	62	51	3,925
40 c.w.	2	5	D	40	48	42	46	34	7,130
20 ph.	2	3	D	65	42	27	27	26	14,260
20 c.w.	1	3	D	65	58	30	28	20	14,100
10 ph.	2	1	D	85	30	41	26	18	28,520
10 c.w.	1	1	D	85	30	44	26	19	28,200

Table 1. Typical tuning chart showing approximate settings of the various controls.

¼ watt neon tube in a screw holder. Although all circuit adjustments are made by meter under normal conditions this neon tube was included in the rig so that in the event of trouble in the field the source of the difficulty could be readily found.

The crystal holder is on the top of the chassis directly under the milliammeter case and immediately adjacent to the base of the 6AG7 oscillator (the tube nearest the front panel).

Three crystals in the 80 meter region cover all amateur frequencies on which a rig of this type is likely to be used. Both phone and c. w. are provided for as follows: 3525 kc.— c. w. on all bands; 3565 kc.—40 c. w., 10 and 20 phone; 3925 kc.—80 meter phone.

No chassis layout is given for the transmitter or modulation chassis since the present layout is shown in the photographs and the individual constructor will no doubt prefer to improve upon the layout and substitute available components. This may be done with assurance since the circuits are very stable.

Switch S_5, shown in Fig. 1 immediately adjacent to the power plug, is another surplus item which lends itself perfectly to the present rig. It is a *W. E.* SW 185 and the positions are shown on the r. f. schematic (Fig. 4). In its "up" position it functions similarly to the push-to-talk button on a crystal or carbon microphone so that the r. f. circuits may be heated up for adjustment without using the microphone switch. It is also used on c. w. where the transmitter may be on for extended periods of time. The other positions are explained on the diagram.

Keying is accomplished, as seen in Fig. 4, through the medium of a small 6 volt d. c. relay, RL_1, again from the surplus market. This relay may be seen in the upper left hand corner of the transmitter chassis in Fig. 3. It will be observed that this relay is not in the circuit until the key is inserted in the keying jack.

When the transmitter is used with an a. c. power pack a small 7½ volt battery must be supplied for use on the d. c. keying relay winding since this relay will not work satisfactorily on a. c. This small battery has its "+" side connected to one leg of the 6 volt a. c. filament circuit and its "—" side connected to pin #7 in the cable going to the modulator and transmitter panels. It will of course be necessary to provide an adapter between the standard P. E. 103 cable and and the a. c. power pack. The small toggle switch labeled "A.C.-D.C." in Fig. 3 (when set for "A.C.") transfers the minus side of the relay winding to pin #7 and a. c. operation on c. w. may then be employed. Of course for phone operation on a. c. such a battery is not needed since the keying relay is not involved.

In Fig. 1 the controls shown are: top row, (left to right) final grid tuning, meter switch, excitation control, and (hidden by corner of audio cabinet) variable link adjustment.

On the bottom row (left to right) are shown the buffer-doubler plate tuning, crystal harmonic output selector (2-A "Band-Hopper" coil and switch assembly), 2-A tuning condenser, final plate tuning, keying jack, J_1, filament control switch S_5, and power input plug P_1.

For ease and rapidity in changing bands the author made up a log giving all the pertinent data involved and, for the benefit of those desiring to make up a similar one, this log is reproduced in Table 1.

Fig. 3 shows a small toggle switch labeled *"Phone—C.W."* In the "phone" position the output of the modulator secondary is connected to the plates and screens of the 815 in the final. In the "C. W." position the modulator transformer secondary is disconnected and "B+" taken straight through to the plates and screens of the 815.

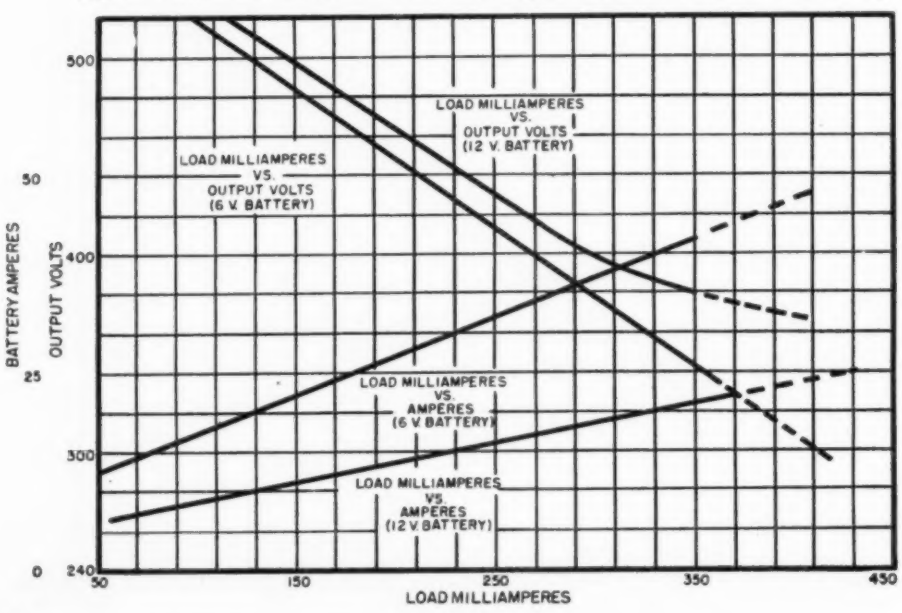
Modulator

The modulator unit is conventional in every respect. The schematic is shown in Fig. 5.

Two 3-pole jacks are used for the crystal and carbon microphone inputs, the 6SJ7 not being in the circuit when the carbon microphone is used. The additional contacts on the jacks are for the PE 103 starter circuit in conjunction with the push-to-talk switches. The surplus market may again be called on to furnish a crystal or carbon microphone. Any type will be satisfactory as the modulator has adequate gain to take care of even the lowest microphone input. The diagram is self-explanatory, but two items might be elaborated upon. The first is the VR 105-30 tube shown in dotted lines on the drawing. From the theoretical point of view the simultaneous modulation of plate and screen grid (as in the 815) requires a very well regulated screen supply such as might be furnished by the part of the circuit pertaining to the VR 105-30. While it is agreed that the theory is correct on this point the added circuit drain due to such a set-up is undesirable in mobile or portable use and, furthermore, experience has shown that in a well constructed and controlled circuit such voltage regulation is not absolutely necessary. The present transmitter

(*Continued on page* 144)

Fig. 8. Performance curves for the PE 103A dynamotor under various loads.



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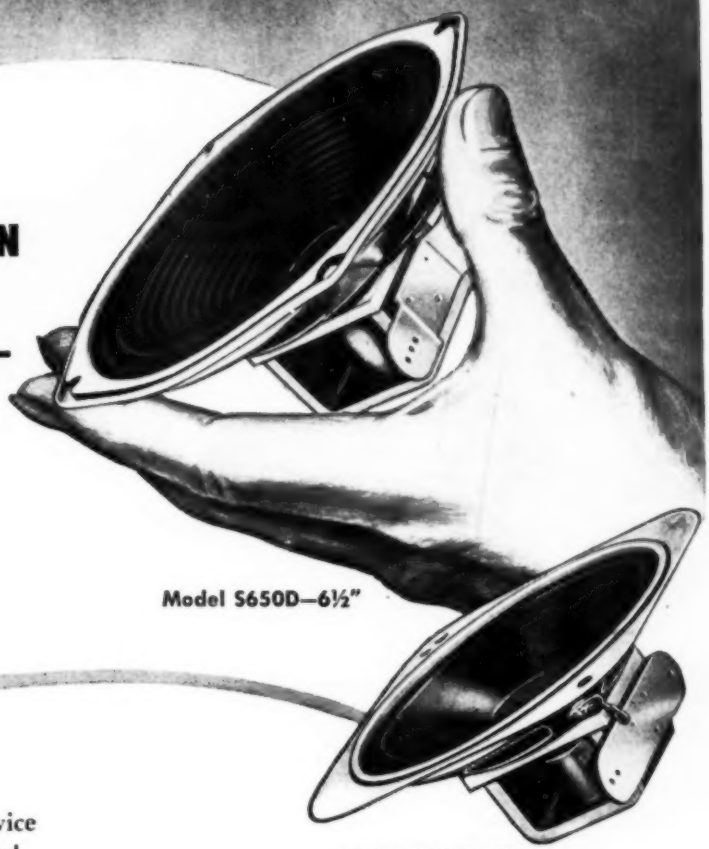
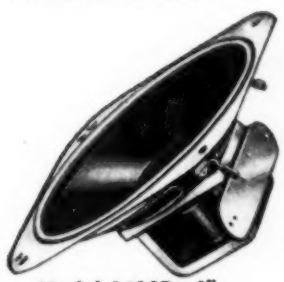


Model S650D—6½"

Model S525D—5¼"



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A RECENT SURVEY shows that 65% of all speaker service requirements are on sets using 4 to 6 inch speakers! Remember—even the smallest General Electric speaker is rated at 4 watts... General Electric speakers, with sturdy all-weld construction, give you higher sensitivity because each G-E Alnico 5 magnet is fixed so firmly in the yoke that hundreds of pounds of pressure cannot budge it!

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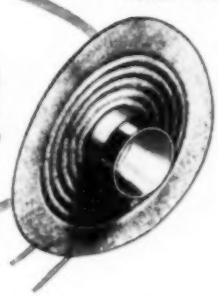

You can put your confidence in—

GENERAL ELECTRIC

CAN 2,710,000 TELEVISION SETS Be Sold in '49?

Sylvania's TV market analysis reveals new facts regarding customer thinking on prices, screen sizes, brands, etc.

DURING 1949, television sets will be purchased by at least 1,580,000 families, but as many as 2,710,000 sets may be sold by the industry if it improves its selling techniques.

This was one of the conclusions reached by *Sylvania Electric Products, Inc.,* researchers as a result of the latest in a series of surveys undertaken by company management to forecast demand and market conditions in the changing television field.

The interviews indicated that 2,710,000 families in television areas may purchase a set in 1949, which is a figure far in excess of the most optimistic guess now being made by the television industry. Frank Mansfield, Director of Research, explained, however, that under present conditions of salesmanship, promotion, programming, and the confusion regarding pricing, frequencies, and screen sizes, the figure of 1,580,000 should be considered the more probable.

The survey disclosed a "terrific increase in latent interest in, and knowledge of, television since a previous analysis made in 1945." At that time, about 9,603,000 families, at most, could be considered prospective owners of television sets at some time in the future. With today's findings, the number of prospects is easily projected at about 16,600,000, or an increase of around seventy per-cent. The current survey indicates that three out of four families in TV areas have purchased, intend to purchase, or are favorable toward television; whereas in 1945, less than half had a comparable interest.

The study further reveals that only eleven per-cent of the people in television areas have not seen television, indicating the great impact of the new medium. In 1945, only sixteen per-cent had seen television, as contrasted with the present-day figure of eighty-nine per-cent. This new knowledge is not merely casual, for by far the greatest bulk of people who have seen it are doing so frequently in homes of friends or relatives, in stores, and other public places.

That television has made a favorable impression on most of those who have seen it is shown by the three out of four people who expressed opinions ranging from enthusiastic to moderately favorable. At least one member of the family is favorable in ninety-one per-cent of the total interviewed. A closer analysis of these latter figures shows that the presence of children in the family has an important effect on the interest in television; if a family has children, the chances of its being interested is about fifty per-cent greater. The husband is found to be the moving influence in most of the interested families, however, the wife being the motivating factor less often.

The 4,600,000 families who have considered purchasing television make up twenty-eight per-cent of all non-owners in television areas, and these are pretty serious about obtaining sets. The greatest part of the *potential* prospects, seventy-seven per-cent, earn less than $100 a week, thus placing the future of television with the great middle-income or "mass" market, according to the survey.

When asked why they have not yet bought sets, the families considering purchase replied that they are "waiting for a cheaper set" or "I can't afford it right now." These two reasons were given by sixty-six per-cent of that group. Minor reasons given are "waiting for a larger variety of programs," and "waiting for better quality programs."

Of the twenty-eight per-cent, the "definitely interested" prospects (4,600,000 families), those who said they would probably buy or may buy in 1949 number 2,700,000. To check the attitudes of these families, the researchers (1) found out what type of set the respondent wanted to buy, then asked what he would pay for it, and (2) showed the types of sets and screen sizes available at the "about-right" prices. The resultant figure shows 1,580,000 *very good* prospects for television sales in 1949.

Although the *Sylvania* interviews reveal how people think, rather than how they will finally act to affect the industry, it also indicates that improved selling—which the previous survey showed is lacking—better promotion and merchandising, and the clearing up of some confusions about television, can overcome the reasons given for not purchasing a set. —30—

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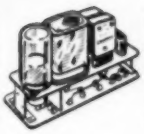

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Everything you want in a television alignment generator. A wide band sweep generator covering all FM and TV frequencies 0 - 110 and 165 to 220 Megacycles, a marker indicator covering 19 to 43 Megacycles, AM modulation for RF alignment — variable calibrated sweep width 0 - 30 Mc. — mechanical driven inductive sweep. Husky 110V. 60 cycle power transformer operated — step type output attenuator with 10,000 to 1 range — high output on all ranges — band switching for each range — vernier driven main calibrated dial with over 45 inches of calibration — vernier driven calibrated indicator marker tuning. Large grey crackle cabinet 16⅛" x 10⅜" x 7-3/16". Phase control for single trace adjustment. Uses four high frequency triodes plus 5Y3 rectifier — split stator tuning condensers for greater efficiency and accuracy at high frequencies — this Heathkit is complete and adequate for every alignment need and is supplied with every part — cabinet — calibrated panel — all coils and condensers wound, calibrated and adjusted. Tubes, transformer, test leads — every part with instruction manual for assembly and use. Actually three instruments in one — TV sweep generator — TV AM generator and TV marker indicator. Also covers FM band.

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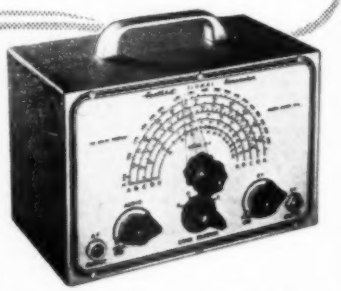

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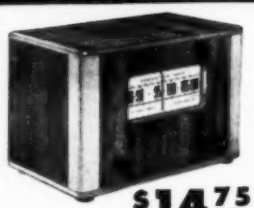
New Heathkit
FM TUNER KIT



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A truly fine FM Tuner with the coils ready wound, all alignment completed — all that is necessary is wiring and it's ready to play — uses super regenerative circuit — 110V. 60 cycle transformer operated — two gang tuning condenser — slide rule calibrated dial — two tubes — complete instructions including pictorial enable even beginners to build successfully. Shipping Wt., 4 lbs.

Beautiful mahogany cabinet for FM Tuner (shown above) extra **$3.75**

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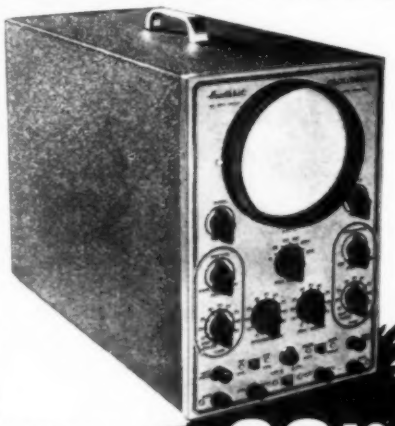

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Features

- **Instant switching to plates or amplifier from front panel.**
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- **All controls on front panel.**
- **Cased electrostatically shielded 110V. 60 cycle power transformer.**
- **AC test voltage on front panel.**
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- **Frequency response ± 20% from 50 cycles to 50 Kc.**
- **Input impedance 1 Megohm and 50 MMF.**

The Heathkit 5" Oscilloscope fulfills every servicing need. The husky cased power transformer supplies 1100 Volts negative and 350 Volts positive. Tubes supplied are two 6SJ7 amplifiers, 884 sweep generator, two 5Y3 rectifiers and 5BP1 CR tube. Grey crackle aluminum cabinet and beautiful grey and maroon panel. Chassis especially designed for easy assembly.

An oscilloscope provides endless sources of experimentation in radio, electronics, medicine and scientific research.

Detailed instructions make assembly fun and instructive. Shipping Wt., 24 lbs. Express only.

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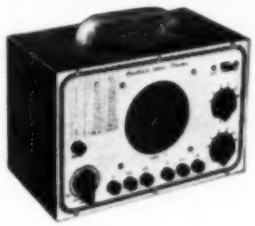

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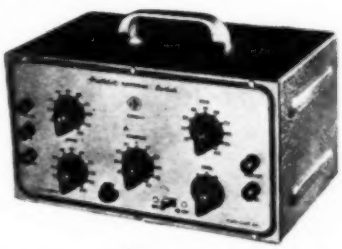
$34.50

Nothing ELSE TO BUY



An electronic switch used with any oscilloscope provides two separately controllable traces on the screen. Each trace is controlled independently and the position of the traces may be varied. The input and output traces of an amplifier may be observed one beside the other or one directly over the other illustrating perfectly any change occurring in the amplifier. Distortion — phase shift and other defects show up instantly, 110V. 60 cycle transformer operated. Uses 5 tubes (1 6X5, 2 6SN7's, 2 6SJ7's). Has individual gain controls, positioning control and coarse and fine sweeping rate controls. The cabinet and panel match all other Heathkits. Every part supplied including detailed instructions for assembly and use. Shipping Wt., 11 lbs.

Heathkit CONDENSER CHECKER KIT

$19.50

Nothing ELSE TO BUY

Features

- **Bridge type circuit**
- **Magic eye indicator**
- **110 V. transformer operated**
- **All scales on panel**
- **Power factor scale**
- **Measures resistance**
- **Measures leakage**
- **Checks paper-mica-electrolytics**

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping Wt., 7 lbs.

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

Heathkits ARE COMPLETE

HEATHKITS are QUALITY

New Heathkit

IMPEDANCE BRIDGE KIT

A LABORATORY INSTRUMENT NOW WITHIN THE PRICE RANGE OF ALL

Measures Inductance from 10 microhenries to 100 henries capacitance from .00001 MFD to 1000 MFD. Resistance from .01 ohms to 10 megohms. Dissipation factor from .001 to 1. "Q" from 1 to 1000.

Ideal for schools, laboratories, service shops, serious experimentors.

An impedance bridge for everyone — the most useful instrument of all, which heretofore has been out of the price range of serious experimentors and service shops. Now at the lowest price possible. All highest quality parts. General Radio main calibrated control. General Radio 1000 cycle hummer. Mallory ceramic switches with 60 degree indexing — 200 micro-amp zero center galvanometer — ½ of 1% ceramic non-inductive decade resistors. Professional type binding posts with standard ¾" centers. Beautiful birch cabinet. Directly calibrated "Q" and dissipation factor scales. Ready calibrated capacity and inductance standards of *Silver* Mica, accurate to ½ of 1% and with dissipation factors of less than 30 parts in one million. Provisions on panel for external generator and detector. Measure all your unknowns the way laboratories do — with a bridge for accuracy and speed.

Internal 6 volt battery for resistance and hummer operation. Circuit utilizes Wheatstone, Hay and Maxwell circuits for different measurements. Supplied complete with every quality part — all calibrations completed and instruction manual for assembly and use. Deliveries are limited. Shipping weight, approximately 15 lbs.

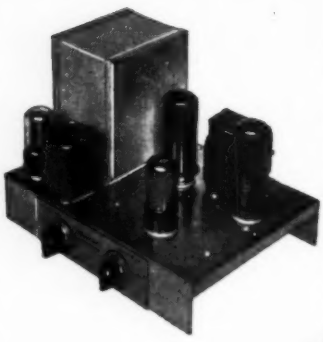
Only **$69.50**

Nothing ELSE TO BUY

Heathkit HIGH FIDELITY

AMPLIFIER KIT

Build this high fidelity amplifier and save two-thirds of the cost. 110V. 60 cy. transformer operated. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SL7), as a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs.



$14.95

Nothing ELSE TO BUY

12" PM Speakers for above **$6.95**

Mahogany Speaker Cabinet, 14½" x 14½" x 8" **$8.75**

New Heathkit

BATTERY ELIMINATOR KIT

Now a bench 6 Volt power supply kit for all auto radio testing. Supplies 5 - 7½ Volts at 10 Amperes continuous or 15 Amperes intermittent. A well filtered rugged power supply uses heavy duty selenium rectifier, choke input filter with 4,000 MFD of electrolytic filter. 0 - 15 Volt meter indicates output. Output variable in eight steps. Excellent for demonstrating auto radios. Ideal for servicing — can be lowered to find sticky vibrators or stepped up to equivalent of generator overload — easily constructed in less than two hours. Complete in every respect. Shipping Wt., 18 lbs.

$22.50

Nothing ELSE TO BUY

Heathkit 3-TUBE ALL WAVE

RADIO KIT

An ideal way to learn radio. This kit is complete ready to assemble, with tubes and all other parts. Operates from 110V AC. Simple, clear detailed instructions make this a good radio training course. Covers regular broadcasts and short wave bands. Plug-in coils. Regenerative circuit. Operates loud speaker. Shipping Wt., 3 lbs.

HS30 Headphones per set **$1.00**
2½" Permanent Magnet Loudspeaker **1.95**
Mahogany Cabinet **2.95**

$8.75

CABINET EXTRA

★ ★ ★ *The* **HEATH COMPANY** ★ ★ ★

. . . BENTON HARBOR 15, MICHIGAN

TEST EQUIPMENT

Famous NAMES IN HEATHKITS

- MALLORY
- CENTRALAB
- SYLVANIA
- KENRAD
- GENERAL ELECTRIC
- DEFIANCE
- ALLEN BRADLEY
- PERMOFLUX
- EBY
- I.R.C.
- CHICAGO TRANSFORMER

Heathkit

TUBE CHECKER KIT

Features

1. Measures each element individually
2. Has gear driven roller chart
3. Has lever switching for speed
4. Complete range of filament voltages
5. Checks every tube element
6. Uses latest type lever switches
7. Uses beautiful shatterproof full view meter
8. Large size 11" x 14" x 4" complete
9. Checks new 9 pin miniatures

Check the features and you will realize that this Heathkit has all the features you want. Speed — simplicity — beauty — protection against absolescence. The most modern type of tester — measures each element — beautiful Bad-Good scale, high quality meter — the best of parts — rugged oversize 110V. 60 cycle power transformer — finest of Mallory switches — Centralab controls — quality wood cabinet — complete set of sockets for all type tubes including blank spare for future types — fast action gear driven roller chart uses brass gears to quickly locate and set up any type tube. Simplified switching cuts necessary time to minimum and saves valuable service time. Short and open element check. No matter what arrangement of tube elements, the Heathkit flexible switching arrangement easily handles it. Order your Heathkit Tube Checker today. See for yourself that Heath again saves you ⅔ and yet retains all the quality — this tube checker will pay for itself in a few weeks — better build it now.

Complete with detail instructions — all parts — cabinet — roller chart — ready to wire up and operate. Shipping Wt., 15 lbs.

Only **$29.50**

Nothing ELSE TO BUY

R.F. CRYSTAL TEST PROBE KIT

No. 309. Kit to assemble. R.F. probe extends VTVM range to 100 Mc. Complete with 1N34 crystal. Ship. Wt., 1 lb. **$6.50**

New Heathkit

TOOL KIT

Now a complete tool kit to assemble your Heathkit. Consists of Krauter diagonal cutters and pointed nose assembly pliers, Xcelite screwdriver, 60 Watt 110V. soldering iron and supply of solder. Shipping Wt., 2 lbs. Complete kit $5.95

10,000V. H.V. TEST PROBE KIT

No. 310. Extends range of any 11 megohm VTVM to 3,000 and 10,000 Volt ranges. A necessity for television. Shipping Wt., 1 pound. **$4.50**

MAIL THIS **ORDER BLANK** *Today*

☐ Enclosed Find Check
☐ Money Order for_____
☐ Please Ship C.O.D.
Postage enclosed for_____ pounds.

From _____

SHIP VIA
____Parcel Post
____Express
____Freight
____Best Way

QUAN.	DESCRIPTION	PRICE	TOTAL

The **HEATH COMPANY**

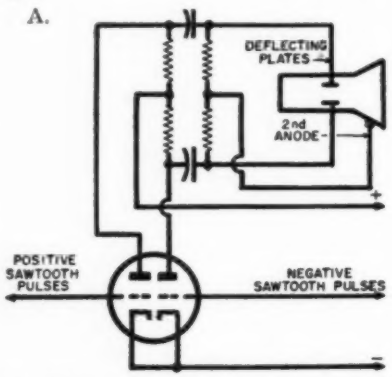
. . . BENTON HARBOR 15, MICHIGAN

DO YOU KNOW?

By DAVID SCOTT

63. Draw a simple schematic diagram of an electron deflection system.

A.

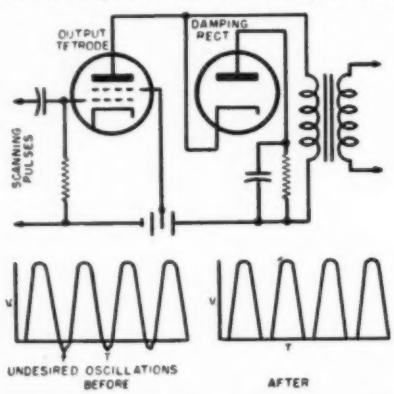


64. What are some of the important design considerations in magnetic deflection systems?

A. *In magnetic deflection systems the same design considerations as in electric deflections systems are necessary. (See question 61). However, added attention must be given to insulation of the coils due to the high peak voltage surges which develop and the distributed capacitance which lends itself to the formation of spurious oscillations.*

65. Draw a simple schematic diagram illustrating and explaining how undesired spurious oscillations may be damped out of magnetic deflection systems.

A. *Spurious oscillations due to the inductance of deflection coils, their distributed capacitance, and high peak voltage surges, which give rise to irregularities in the scanning motion, can be eliminated with a damping circuit, i.e., a rectifier tube in series with a shunt capacitance resistance combination, the whole circuit being shunted across the primary or secondary of the transformer. The rectifier has a very low impedance to the portion of the oscillation which makes its anode positive, and this energy is absorbed in the tube. The waveform is thereby damped so far as the high-frequency oscillations are concerned, and the current has the required linear form.*



66. What is the function of the discharge tube in a saw-tooth generator system?

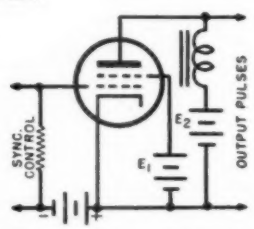
A. *The discharge tube is the part of the saw-tooth generator which suddenly removes the charge from the condenser across which the saw-tooth wave is built up.*

67. What is the function of an impulse generator?

A. *The impulse generator causes the discharge tube to act by the application of a sudden positive voltage pulse on its grid. If this pulse is very sharp, i.e., of large amplitude and small duration, the discharge tube will assume a correspondingly low impedance for a comparatively short time.*

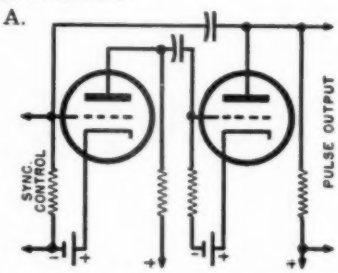
68. Draw a simple diagram of a dynatron.

A.



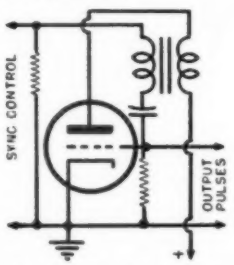
69. Draw a simple diagram of a multivibrator.

A.



70. Draw a simple diagram of a blocking oscillator.

A.



71. What are the two types of frequencies in sync action?

A. *In sync action, there is a free frequency and the sync frequency.*

(To be continued)

ST. GEORGE WIRE RECORDER MECHANISM $22.95

Majestic Wire Recording Radio Chassis, St. George Mechanism. Mike, Etc., As Pictured $49.95

★ REGULAR $75.00 LIST ★ BRAND NEW

Brand new Wire Recorder. Play back mechanism. Same as those used on the majestic radio wire recorder. This unit has 78 RPM Turntable for recording on wire from a phono record. Records up to 1 Hour on standard Webster Recording Wire. This wire recording mechanism is offered to you at a fraction of the regular net. Space required 9x13x3½" below board. Each unit is furnished with Oscillator Coil and a diagram to show how to wire a 2-Tube Osc. (We furnish special Osc. coil not small part for Oscillator) and how to adapt the wire recorder to any radio or amplifier. Ready punched for crystal phono pick up. St. George wire record head with Osc. Coil and diagram. Stock No. X93, weight 15 lbs. Net **$22.95.**

Crystal Pickup Arm for Playing 78 RPM record **$2.95** extra. Webster Recording Wire, 15 Min. **$1.30**, 30 Min. **$1.95**, 1 Hr. **$3.25**. Bullet Stand Shure Crystal Mike **$4.95.**

★ RECORDS FROM 78RPM RECORDS

This complete radio Wire Recorder combination includes the St. George Wire Recorder mechanism, Majestic Broadcast Receiver Chassis and Wire Recording oscillator. The receiver is a 2 Gang superhet with 7" slide rule dial (11X6X5) Tube compliment 12SA7, 12SK7, 12SJ7 12SQ7, 50L6, 50B5, 35W4. The oscillator for wire recording is built on a small 5X5 separate chasis. Each unit has plugs and sockets for easy quick connection. Brand new wired in the majestic factory for use in their $200.00 radio wire recorder. Everything you need to record on wire from the radio, mike or phono record is furnished. Crystal mike, 15 Minute Spool of Wire, Majestic wire recording radio, 6" speaker and St. George Wire Recorder Play back Mechanism, all for only **$49.95.** Weight 30 lbs. Extra recording wire, 15 Min. **$1.30**, 30 Min. **$1.95**, 1 Hr. **$3.25.**

100 RADIO TUBES $29.95

250,000 Tubes for fast sale. Tremendous value. Tubes up to $3.00 list. 100 Cartoned and branded Hyvac Miniature Tubes for $29.95. Over a million sold. Guaranteed full replacement. 34c Each in smaller quantities.

1R5	12BE6	12AU6	6SU7	12S8	
1T4	12AT6	12BF6	6AQ5	9001	**$29.95**
1U5	35W4	6BA6	6AQ6	9002	
3A4	35B5	6BE6	6C4	6BH6	for 100
3S5	50B5	6AT6	6X4	117Z3	
3V4	12AT7	6AL5	6W4	19T8	34c each
3Q4	12AU7	6AQ5	6AG5	6BJ6	
3S4	12AX7	6BF6	6AU6	6AT6	
12BA6	12BA7	6AU7	6BG6		

Popular GT Tubes, individually cartoned and branded Hyvacs. $35.00 per hundred. 39c Each in smaller quantities.

6V6	6X5	6SK7	12SF7	12SN7	32L7	**39c each**
6SN7	6SD7	6SQ7	6J5	12BF7		
6C5	5Y3	25L6	6SJ7	6SL7		**100 for $35.00**
6P5	6K7	70L7	12SJ7	35Z5		
12A8	5Y3	1B4	6SF5			
6S8	6K6	12K8	80			**HYVAC 6AK5 AND 6J6 59c EACH**
12S8	6SA7	12A6				

STANDARD BRAND TUBES

CARTONED and UNCARTONED **49c**

02AG	1G6	5V4	6F7	6SA7	6T7	7B8	7S7	12F5	12SL7	25Z5	35Z5	77
1A4	1H6	5Y3	6H6	6SC7	6V6	7C4	7V7	12H6	12SN7	25Z6	38	78
1A6	1J6	6A3	6J5	6SD7	6X5	7C5	7Y4	12J5	12SQ7	26	39	80
1B4	1L4	6AB7	6J7	6SF5	6Y6	7C6	7Z4	12K8	12SR7	27	43	
1B5	1R5	6AC7	6K5	6SF7	6Z7	7C7	10Y	12Q7	12Z3	30	45Z5	
1C6	1S5	6AG7	6K6	6SG7	6ZY5	7E5	12A6	12SA7	14A7	32	50B5	
1C7	1T4	6B8	6K7	6SH7	7A4	7E7	12A8	12SC7	14B6	33	50L6	
1D5	1V	6C4	6K8	6SJ7	7A5	7F7	12AH7	12SF5	14C7	34	56	
1D7	2A5	6C5	6L5	6SK7	7A6	7H7	12AT6	12SF7	14H7	35	57	
1D8	2A6	6C6	6L7	6SL7	7A7	7L7	12BA6	12SG7	14Q7	35L6	58	
1F4	2A7	6D6	6N7	6SQ7	7B4	7N7	12BD6	12SH7	14R7	35W4	70L7	
1F5	3S4	6D8	6R7	6SR7	7B5	7Q7	12BE6	12SJ7	19	35Y4	75	
1G4	5T4	6F5	6S7	6SS7	7B6	7R7	12C8	12SK7	25L6	35Z4	76	

NAME BRAND 1½ VOLT LOCTALS, ETC.

1LN5	1LD5	1LH4	1LC6	1LA6	1LB4	59c	10 for $6.50
1LC5	1LG5	3LF4	1LE3	1LA4	——	59c	10 for $6.50
1A7	1H5	1A5	1N5	3Q5	1T5		
1Q5	1P5	1C5	1G4	1C6	117Z6	59c	10 for $6.50
0Z4	69c Each, 100 for $59.50		35A5	50A5	69c Each.		6L6 Metal 99c

BUILD A RADIO WITH MATCHED "DETROLA" PARTS

6-TUBE 2-BAND KIT $16.95

A complete kit of parts, tubes and ready punched chassis to build a fine 6 tube power transformer type radio chassis. (No cabinet.) We furnish every piece as well as a printed diagram and photograph. Chassis size 14x7½x7. Receives standard broadcast and 6 to 18 MC foreign short wave. 3 gang tuning condenser used on both bands. 90 mil power transformer. 6v6 output tube. Heavy duty 8 inch speaker. This kit is made up of parts intended for use in a high quality Detrola radio. Has full lighted slide rule dial. Everything goes together just like a factory built radio. Priced complete with 6 tubes. Kit model 6-AC. Weight 16 lbs. net **$16.95.**

Kit model **CD-8.** Same basic design as the above model 6-AC except it is an 8 tube AC DC circuit with push pull 25L6 tubes in the audio. Weight 15 lbs. Priced complete with tubes net **$16.95.**

BUILD THIS

8-TUBE HI FIDELITY RADIO AND AMPLIFIER

8-Tube Kit **$37.95**

- 8-INCH SLIDE RULE DIAL
- RECEIVES BROADCAST and 19 to 49 METERS
- PUSH PULL OUTPUT TUBES
- BASS BOOST TONE CONTROL
- EVERYTHING FURNISHED
- CHASSIS SIZE 9½ x 11 x 8" HIGH
- BEST RADIO KIT VALUE IN THE WORLD

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SB7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 26 lbs.

PRK-24. Radio-Amp. Kit with 12" P.M. speaker. With tubes.....Net **$29.95**

CPR-15. Exactly the same kit as the PRK-24 kit, except it is furnished with a 12" Cinaudagraph wide range speaker. (Has built-in high frequency tweeter.) This is our finest kit.....Net **$37.95**

COMPLETE RADIO KITS $6.95 UP

Kit Model X-45 **$14.95**

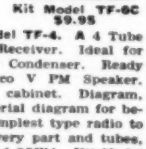
Complete Personal Portable Radio Kit Model X-45. Made from genuine Garod factory-matched parts. A complete kit to build a broadcast battery operated 4 tube receiver. Small in size 6½x3¼x4½", Weight 3½ lbs. 2 Gang Superhet circuit set comes on when lid opens. Rugged metal case with colored plastic front and back. Loop antenna in lid. Furnished with diagram and photos, tubes and 67½ B-Battery. Will go together like a factory built radio. Shipping weight 6 lbs. 8 Tube 2X-45, **$14.95.** Wired and tested **$17.95.**

Kit Model DE-6X **$6.95**

Complete Mike Broadcaster Kit Model DE-6X. Broadcasts 800 to 1500 KC from either a phonograph pick up or mike. Makes any radio receiver a P.A. system or recording amplifier. Broadcast tone quality. Has fader control from mike to record simulating a regular broadcast stations. Works on 110V. AC-DC. Ready punched chassis. Price includes a wiring diagram, photos and tubes, 2-35B5, 12SJ7, 35W4. Kit Model DE-6X. Weight 4 lbs. Net **$6.95.** Crystal Mike and desk stand **$4.95** extra.

Kit Model TF-4 **$6.98**

Complete Radio Kit Model TF-4. A 4 Tube AC-DC Broadcast TRF Receiver. Ideal for the beginner. 2 Gang Condenser. Ready punched chassis. Alnico V PM Speaker. Airplane Dial. Plastic cabinet. Diagram, photos and special pictorial diagram for beginners. This is the simplest type radio to wire. Price includes every part and tubes, 12SK7, 12SJ7, 50B5 and 35W4. Kit Model TF-4. Weight 6 lbs. Net **$6.95.**



Kit Model TF-6C **$9.95**

Complete Radio Kit Model TF-6C. A full size broadcast AC-DC. 2 Gang Superhet. Lighted slide rule dial. 13" wood cabinet with plastic front. Loop antenna. Made from Detrola matched parts. Price includes tubes, diagram and photo. 12BA6, 12BE6, 12AT6, 50B5, 35W4, 5" speaker. Weight 9 lbs. This is an ideal kit for the student. Kit Model TF-6C, **$9.95.**

WIRE RECORDER and 18-WATT P.A. SYSTEM

SALE PRICE **$89.95**

Three years of wire recording experience has lead us to the development of this combination wire recorder and public address system. Housed in an attractive portable case with hinged lid on the recorder compartment. Beautiful streamlined plastic grill. Storage compartment in back panel for mike and accessories. Size 21x11x14. A full 18 watt HI FI amplifier with P.P. 6V6 tubes in output stage and separate 6AQ5 erase circuit. This new super erase circuit eliminates all the bugs in wire recording. 12 inch Alnico V. P.M. speaker. Extension speaker jack. Mike input, tone control. Equipped with the St. George wire recorder playback mechanism that has 78 rpm turntable and General Electric Variable reluctance pick up. You can record or play phono records. Record from mike. The play back quality is tops. Plenty of volume and good fidelity. This is also a top wire recorder. Unit is completely assembled and ready to operate. Furnished with a crystal mike and desk stand and 15 minute spool of Webster recording wire. Extra recording wire, 15 min. **$1.30**, 30 min. **$1.95** hour, **$2.25.**

Model GE-15 Portable public address system and wire recorder shipping weight 38 lbs. Net **$89.95.**

FARNSWORTH CABINET AND CHASSIS $2.95

Farnsworth model GT-061. We offer you just the 12 inch beautiful plastic cabinet. Chassis pan with 6 octal tubes sockets. Dial bracket and dial glass. This is not a complete kit only the listed parts are furnished. A scoop while they last. Weight 6 lbs. Net **$2.95.**

WALNUT ARM CHAIR CABINET $29.95

This cabinet is OK for S-56 Hallicrafters WILL HOUSE CRP-15 KIT. Beautifully made walnut armchair cabinet. Outside dimensions 24" high, 16½" deep and 27" wide. Ample room for radio receiver 14" long, 9" high, and 10" deep. Will hold a changer up to 14" square. Will accommodate speaker up to 12". Has record album storage compartment. Hinged lid covers changer compartment. Cabinet AR-15. Net price **$29.95.** Crescent DeLuxe changer **$14.95** extra. Armchair cabinet in blonde finish. Net price **$34.95.**

RECORD PLAYER KITS $9.95 AND UP

Capitol Portable Case

Deluxe Portable Record Player Kit housed in the attractive Capitol case. Includes all parts and easy to follow diagram. Has 4" Heavy Duty PM Speaker. 78 RPM Phono Motor. All necessary parts to build a 70L7 type Amplifier. Weight 14 lbs. Model CR-1. Net **$9.95.**

Portable Player Kit for L.P. $19.95

Complete Record Player with wired 4-T AC-DC Amplifier. Component parts shipped separately. 4x6" PM Speaker. Brown leatherette Capitol portable case with chrome trim case. Dual speed phono motor 33⅓ and 78 RPM. 2 Pickup Arms, LP & Standard. Only a few minutes required for assembly. A fine player to own. Stock No. LP-CC8. Net **$19.95.** Weight 17 lbs.

Model CC-8, same as above only for regular 78 RPM records only. Weight 18 lbs. Net **$14.95.**

AC-PORTABLE PLAYER $19.95

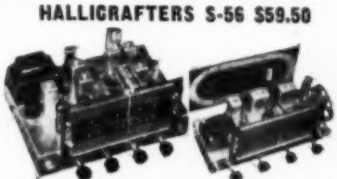
Super deluxe record player with push-pull 7C5 A C type amplifier and 6 inch speaker. All you do is mount amp. in the case. Case is of the accepted type. This player should sell for $35.00. Stock No. DL-3. Net **$19.95.**

Offered with Stewart-Warner automatic changer. Stock No. ARO-4. Net **$27.95.**

4-TUBE PHONO AMP. $7.95

4 Tube Phono Amplifier with 6", 3½ Oz. Alnico V PM Speaker. 4 Tubes: 2—35Z5, Voltage double, 12SQ7, and 35L6. Tone and Volume Controls. Small thin chassis. Made for a $1 mail order house. Plenty of power. Offered at less than production cost. Stock No. 5R-4. Weight 7 lbs. Net **$7.95.**

HALLICRAFTERS S-56 $59.50



11-TUBE FM / AM MODEL S-56 .....$59.50

8 - TUBE FM / AM MODEL S-59 .....$39.95

Hallicrafter S-56, 11 Tube AM/FM Chassis (AFC on FM.) A regular $110.00 Net Chassis. New factory Cartoned with tubes. Only a few sets left. Weight 25 lbs. Net **$59.50.**

500 Ohm to Voice Coil Speaker matching Transformer **$2.50.**

Hallicrafter S-59, 8 Tube AM/FM Receiver Chassis. Has push-pull 6K6 Audio. A real value while our 100 Chassis last. Weight 16 lbs. With tubes, Net **$39.95.**

500 Ohm to Voice Coil Speaker matching Transformer **$2.50.**

Speakers recommended for S-56 & S-59—C8-13X, 5-15X or A-30, advertised on this page.

Our Leader Magnetic Tape Recorder

$250 List—Net $149.50

Magnetic tape recorder of nationally known manufacturer, complete ready to operate. Has AC transformer type amplifier for recording and playback. Housed in an attractive leatherette case, with microphone. Makes a 30 minute recording from standard magnetic tape. Made to sell for $250.00 list. McGee's scoop price **$149.50.** Circular sent on request.

Tape Recorder Mechanism $59.50

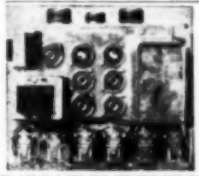
Brush Magnetic tape recorder-playback mechanism as used on the famous Brush recorder. Furnished with a diagram of a tape recorder. Weight 20 lbs. 30 minute spools of Scotch recording tape **$2.90.**

15 inch P.M. 6 Lb. Mag. **$26.95**

PM 6 Pound Alnico 5 Magnet 1½" 8 Ohm Voice Coil made for heavy duty use. Brand new factory cartoned. Weighs 22 lbs. Regular **$55.00.** List sale price **$26.95.**

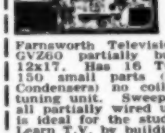
AMERICAN BEAUTY $4.95

American Beauty Radio type soldering iron with removable set screw tip. Brand new, factory cartoned with stand. 150 Watt. Standard radio size. Scoop price **$4.95.**



AUTO PILOT $1.00

CIT auto pilot scoop less tubes. Has 6 sensitive relays and other parts. Shipping wt., 13 lbs., **$1.00.**



TELEVISION CHASSIS SCOOP $5.95

Farnsworth Television Chassis Model GVZ60 partially built up Chassis Size 12x17. Has 16 Tube sockets and over 150 small parts (Resister and Ceramic Condensers) no coils or Transformers or tuning unit. Sweep and sync circuits are all partially wired up. This T.V. Chassis is ideal for the student and experimenter. Learn T.V. by building your own set using this chassis to start from. Furnished with a 1948 regular $3.00 Supreme Publications Television Manual, which has complete schematic of this chassis as well as 9 pages of service information.

If you want to play with Television here is a chance to get started.

Farnsworth GVZ60 partially built up Chassis and 48 Supreme T.V. Manual all for $5.95. Include postage for 11 lbs. GVZ60 Chassis only **$2.95.**

GVZ60 Power Transformer, C-94230Z. A 135 Mill Tapped 110 Volt primary. Supplies plate voltage and filament for part of Farnsworth T.V. Chassis. 375 V.D.C. 6.3 and 5 filament. Shipping wt. 7 lbs. Scoop price **$2.95.**

GVZ60 8 Channel RF-Osc. front end. Receives any 8 of 13 channels. Built on rotary switch principle. All coils and tubes, socket wired up. Requires 6BA6, RF 6AQ5 mixed, 6J6 osc. Output to Video IF. Shipping weight 2 lbs. Scoop price **$2.95.**

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with order, Bal. Sent C.O.D. With parcel post orders include postage.

NOW AT OUR NEW AND LARGER QUARTERS
1422 GRAND AVE., KANSAS CITY, MISSOURI

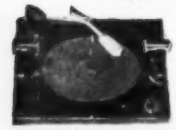
FAMOUS CAPEHART-2 POST AUTOMATIC RECORD CHANGER $19.95

★ THIS IS THE SAME CHANGER INCORPORATED IN THE $600.00 CAPEHART RADIOS

★ FURNISHED WITH EXTRA TONE ARM AND THREE CARTRIDGES, CRYSTAL V.R. AND TRUE TIMBER

★ NOW YOU CAN COMPARE ALL CARTRIDGES AT LOW COST TO YOU

★ WE BOUGHT A SOLID CARLOAD TO BE ABLE TO MAKE THIS LOW $19.95 PRICE



CAPEHART TWIN POST $19.95

We made an outstanding purchase of genuine Capehart Twin Post Automatic Record Changers. This is the changer that was incorporated in the famous Capehart Radios selling in the $600.00 bracket. Do not confuse this with ordinary $20.00 or $30.00 changers. This one is of super heavy duty construction. Made of heavy parts with easy accessible adjustments. Base size 14¼x14¼". Positive action twin post design plays 10—12" or 12—10" 78 RPM records automatically. We are passing our lucky purchase on to you.

This changer is equipped with the True Timbre transparent plug in cartridge with permanent needle. (Requires same gain as Variable Reluctance Cartridge.) We also offer at no added cost to you an extra tone arm with two spare cartridges. The famous Caltron Variable Reluctance Broadcast quality cartridge as well as a standard output crystal cartridge. This deal gives you a changer with all types of cartridges. Only a limited quantity of these changer deals are available, so get your order in now. Schematic diagrams furnished for all types of cartridge inputs. You get Capehart Two Post Changer with True Timbre Cartridge, extra tone arm with Caltron Variable Reluctance Cartridge and Standard Output Crystal Cartridge all for **$19.95.** Shipping weight 23 lbs. If you desire we will throw in a General Electric RPX-010 Variable Reluctance Cartridge for **$2.50** extra.

Capehart Changer with True Timbre Cartridge, extra arm, Crystal & VR Cartridge, **$19.95**; with RPX-010 G.E. Cartridge added, **$22.45** net.

ELECTROLYTICS UPRIGHT ALUMINUM CANS

Save half on these genuine aluminum can upright screw mounting. Fresh Stock One year guarantee.

RS213	8 mfd.	450V.	1 x2¾"	$0.49
RS215	12 mfd.	450V.	1 x2¾"	.54
RS223	30 mfd.	450V.	1⅝x3"	.59
RS262	8x8 mfd.	450V.	1⅛x3¾"	.59

Type TC8 Aluminum tubes with paper insulating tubes. Separate sections with lugs. Buy a good supply of these at over half off. Fresh stock. One year guarantee.

TC845	20x20	mfd.	150V.	1x2¾"	$0.39
TC847	30x30	mfd.	150V.	1x2¾"	.44
TC848	40x40	mfd.	150V.	1x2⅞"	.49
TC852	10x10	mfd.	250V.	1x2¾"	.29
TC855	20x20	mfd.	250V.	1x2¾"	.34

Type TCD Dual with Common Neg. and 3" Leads.

TCD55	20x20	mfd.	250V.	1x2"	$0.34
TCD52	10x10	mfd.	250V.	1x2"	.29
TCD65	20x20	mfd.	350V.	1x3"	.34

St., 2N, 3S, 4S. Cardboard Tubes with metal tabs for vertically or under chassis mounting. Fresh Stock. One year guarantee.

ST595	8	mfd.	450V.	⅞x2½"	$0.29
ST597	16	mfd.	450V.	1x2¾"	.39
ST598	20	mfd.	450V.	1x2¾"	.44
ST599	30	mfd.	450V.	1x3½"	.49
2N500	20x20	mfd.	150V.	⅞x2⅜"	
2N518	8x8	mfd.	450V.	1x2¾"	.49
2S556	30x30	mfd.	150V.	1x2⅞"	.44
3N533	30x30	mfd.	150V.	20x25V.	.54
3S579	8x8 mfd. 450V. 20x25V. 1¼x2⅞"				.54
3S584	8x8x8 mfd. 450V. 1⅝x2⅞"				.69

GENERAL ELECTRIC RPX-010

REGULAR $7.95 LIST VARIABLE RELUCTANCE PICK-UP CARTRIDGE ON SALE FOR $2.95

The widely publicized and nationally advertised General Electric RPX-010 Variable Reluctance pick-up Cartridge for standard 78 RPM records. Permanent sapphire needle. Made to sell to the dealer at $4.67. A lucky purchase by us enables this low price of only **$2.95.** Packed 18 to a master carton. Better stock up now. Kit to build a G.E. type pre-amplifier with wiring diagram and 6SC7 tube, **$2.49** extra.

Astatic MLP-1 $1.39, 10 for $12.50

Astatic MLP-1 Cartridge with permanent needle. This model used on many original equipped changers. Priced at below cost of needle, **$1.39**; 10 for **$12.50.**

Astatic MLP-2, same as MLP-1, only later model with QT needle. No surface noise. Sale price, **$1.95.**

Astatic NJ-Nylon cartridge with permanent, but changeable needle, **$3.29.**

Astatic QT 3-M cartridge with silent needle response to 10,000 CPS. Reg. $8.40 List. Scoop price, **$3.29.**

Shure TN305 or TO305 Cartridges with needle, **$2.49.**

Astatic LTM Cartridge with needle. Scoop price. **$2.49.**

COMPLETE PICK-UP ARM, $1.95.

Standard plastic pick-up with 3½ Volt Cartridge, Webster made, **$1.95.** Standard pick-up, light weight, with either 1 Volt or 3½ Volt Cartridge, **$2.29.**

Micro Groove pick-up with permanent needle for L. P. Records, **$3.95.**

CRYSTAL CARTRIDGES

WE HAVE 'EM, $1.39 AND UP

EVERY XTAL GUARANTEED

3 Cartridges—95% Off Your Need $1.79 Each, 10 for $15.00

Astatic L-40 or equal, with rest clip, replaces the following: L-41, L-75, Webster C-5, E-9, F-3, N-3, N-5, or N-7. **$1.79** each; 10 for **$15.00.**

Astatic L-70 or equal, with rest clip. Replaces the following: L-22, L-26, L-27, L-71, L-76 or Shure, P-88, P-89, W-40, W-59 or Webster, 1X6, 1X2, N-4, E-4, etc. **$1.79** each: 10 for **$15.00.**

Astatic L-72 or equal, with rest clip. Replaces the following: L-24, L-46, Shure P-89 and Webster, N10P5 a 3 Volt Output that will drive single tube record players and put extra power in any player. The most universal crystal built. **$1.79** each: 10 for **$15.00.**

CALTRON V.R. CARTRIDGE, $2.95

Caltron Variable Reluctance Standard size cartridge as used in broadcast stations. Has permanent needle. A $15.00 cartridge for only **$2.95.**

GE Variable Reluctance Cartridge RPX-040 with replaceable needle **$5.85.**

GE RPX-041 1 Mill Micro-Groove **$5.85.**

Solar Wet Electrolytics

Genuine Solar Screw Mounting Wet Electrolytics.

8 mfd.	500 Volt wet.	Solar	$0.87
16 mfd.	500 Volt wet.	Solar	1.23
20 mfd.	500 Volt wet.	Solar	1.32
8 mfd.	600 Volt wet.	Solar	1.32
16 mfd.	600 Volt wet.	Solar	1.80

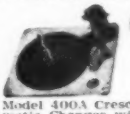
G.I. RM-4, $5.95

General Industries RM-4 heavy duty phono motor with T.T. 78 RPM. Scoop price **$5.95**

Deluxe quality 78 RPM phono motor with T.T. **$2.95**

Dual speed phono motor 33⅓ or 78. Reg. $11.00 list, scoop price **$4.95**

Scoop-Replacement phono motor fits 90% of all changers. A scoop at only $1.39 ea.



CRESCENT DELUXE CHANGER ONLY $14.95

Model 400A Crescent Deluxe 78 RPM Automatic Changer with shure cartridge. Shuts off on last record. Base size 11½x13½". Deep maroon finish. Weight 11 lbs. Scoop price **$14.95**

Aero 78 RPM Automatic Changer with Q.T. Cartridge and permanent needle. Base size 12x13". Scoop price **$12.95.**

Two for **$24.95**

VM-800 78 RPM Automatic Changer. Base size 13½x14". A wonderful buy at **$12.95.** Two for **$24.95**

Farnsworth 78 RPM 2-Post Automatic Changer with new variable reluctance cartridge. Net **$19.95**

VM-400 78 RPM Automatic Changer. Intermixes 10" and 12" records. Space required 12½x13". A Scoop at only **$19.95**

Triple Post 78 RPM Seeburg Automatic Changer. Super construction. Intermixes 10" and 12" records. Base size 14½x14". Price **$29.95**

Popular Detrola Changer **$12.95**

General Instrument 78 RPM Automatic Changer. A fine small changer. Base size 10½"x12". Net **$14.95**

Leatherette made to fit bases for any of the above changers **$1.95** each.

WEBSTER DUAL-SPEED

World famous Webster Chicago model 256 dual speed automatic changer for the regular 78RPM records or the new 33⅓ micro-groove records. New pick-up with needles mounted in tandam for flip of the wrist change. Base size 14x14". This is the famous Wilt-o-matic model. Weight 18 lbs. Net **$31.53**

Webster model 246 dual speed automatic changer is a fine changer at a lower price and also requires less space. Weight 15 lbs. Net **$28.34**

Both Webster 256 and 246 are equipped with 1½" Washer in 45 RPM Motor drive shim to play 45 RPM records manually.

VM Model 802 Three-Speed Record Changer, Plays 10" and 12" records. 33⅓ or 78 RPM records automatically, and 7" 45 RPM or 33⅓ RPM records manually. Has 3-speed motor. Base size 13½x14. Weight 16 lbs. Net **$29.95**

VM 800D Dual Speed 33⅓ and 78 RPM automatic changer. Weight 15 lbs. Net **$23.80**

SALE! NATIONAL UNION

ORDER $100.00 WORTH OF N.U. COND.—TAKE 10% OFF

100,000 FOR SALE AT OVER ½ SAVING. PLENTY OF EACH SIZE.

We bought the entire stock of National Union Electrolytics, Tubular By-passes, and Sav-A-Shaft Volume Controls. Stock up now while pickings are good. All National Union Condensers offered by us are late 1948 production by a Number One builder of Electrolytics. Guaranteed by us for a period of one year. You must be satisfied with the merchandise we ship you. Order $100.00 worth of these N. U. Condensers and take 10% off of price.

SC TT AT CT T

TYPE "AT" N.U. TUBULAR ELEC. ALUMINUM WITH SEALED ENDS

National Union Type AT Electrolytics. Housed in sealed metal tubes in spun-end cardboard sleeves. Bare wire leads. Standard package of 10 condensers. Save over half. This is your every day need in condensers. One-year guarantee.

AT 10 MFD.	25 Volt	11/16x1⅜"		15c
AT 25 MFD.	25 Volt	11/16x1⅜"		20c
AT 50 MFD.	25 Volt	11/16x1⅜"		20c
AT100 MFD.	25 Volt	11/16x1¾"		25c
AT 5 MFD.	50 Volt	11/16x1⅜"		10c
AT 10 MFD.	50 Volt	11/16x1⅜"		15c
AT 25 MFD.	50 Volt	11/16x1⅜"		20c
AT 50 MFD.	50 Volt	11/16x1⅜"		20c
AT100 MFD.	50 Volt	11/16x1¾"		25c
AT 4 MFD.	150 Volt	11/16x1¾"		10c
AT 8 MFD.	150 Volt	11/16x1¾"		15c
AT 12 MFD.	150 Volt	11/16x1¾"		20c
AT 16 MFD.	150 Volt	11/16x1¾"		25c
AT 20 MFD.	150 Volt	11/16x1¾"		25c
AT 24 MFD.	150 Volt	13/16x1¾"		25c
AT 30 MFD.	150 Volt	13/16x1¾"		25c
AT 40 MFD.	150 Volt	13/16x1¾"		30c
AT 50 MFD.	150 Volt	13/16x1¾"		35c
AT 80 MFD.	150 Volt	15/16x2⅛"		35c
AT 8 MFD.	250 Volt	11/16x1¾"		20c
AT 16 MFD.	250 Volt	13/16x1¾"		25c
AT 20 MFD.	250 Volt	13/16x1¾"		25c
AT 24 MFD.	250 Volt	13/16x1¾"		25c
AT 30 MFD.	250 Volt	15/16x1¾"		30c
AT 40 MFD.	250 Volt	15/16x1¾"		30c
AT 4 MFD.	450 Volt	13/16x1¾"		20c
AT 8 MFD.	450 Volt	13/16x1¾"		30c
AT10 MFD.	450 Volt	13/16x1¾"		30c
AT12 MFD.	450 Volt	15/16x2⅛"		35c
AT16 MFD.	450 Volt	15/16x2⅛"		40c
AT20 MFD.	450 Volt	15/16x2⅛"		40c
AT30 MFD.	450 Volt	1-1/16x2⅛"		50c
AT40 MFD.	450 Volt	1-1/16x2⅝"		50c
AT16 MFD.	525 Volt	1-1/16x2⅛"		45c

DUAL SECTION COMMON NEG.

AT 8-8 MFD.	150 Volt	13/16x1¾"	20c
AT 8-16 MFD.	150 Volt	13/16x1¾"	20c
AT20-20 MFD.	150 Volt	13/16x1¾"	25c
AT30-30 MFD.	150 Volt	15/16x2⅛"	35c
AT40-20 MFD.	150 Volt	15/16x2⅛"	35c
AT40-40 MFD.	150 Volt	15/16x2⅛"	40c
AT50-30 MFD.	150 Volt	15/16x2⅛"	50c
AT50-50 MFD.	150 Volt	15/16x2⅛"	55c
AT80-40 MFD.	150 Volt	1-1/16x2⅛"	60c
AT 4-4 MFD.	450 Volt	15/16x2⅛"	25c
AT 8-8 MFD.	450 Volt	15/16x2⅛"	40c
AT10-10 MFD.	450 Volt	15/16x2⅛"	40c
AT 8-16 MFD.	450 Volt	1-1/16x2⅛"	45c
AT16-16 MFD.	450 Volt	1-1/16x2⅝"	50c
AT20-20 MFD.	450 Volt	1-1/16x2⅝"	60c

TYPE "CT" ELECTROLYTICS DUAL TUBULAR BANKS

National Union Type CT Cardboard tubular with wax seal and mounting strap. Flexible leads. Individually cartoned in green N.U. boxes. A red hot value at over ½ saving. One-year guarantee.

CT16-16 MFD.	150 Volt	⅞x2¾"		25c
CT20-20 MFD.	150 Volt	⅞x2¾"		30c
CT30-30 MFD.	150 Volt	1 x2⅜"		35c
CT40-20 MFD.	150 Volt	1 x2⅜"		35c
CT40-40 MFD.	150 Volt	1 x2⅝"		40c
CT50-30 MFD.	150 Volt	1 x2⅝"		50c
CT80-40 MFD.	150 Volt	1 x2¾"		60c

DUAL SECTION 4-LEADS

16-16 MFD.	150 Volt	1x2¾"	30c
20-20 MFD.	150 Volt	1x2⅝"	35c

N.U. 600-VOLT TUB. BY-PASSES

National Union attractive green paper 600 Volt Tubular Condensers. Super sealed, wax filled, rigid tinned leads. Save 2/3 on these. All 1-year guarantee. Order 100 assorted, you pick size, for **$6.95.**

T .0001, T .00025, T .0005, T 001, T .002, T.005, T .006—**5c** Each.

T .02, T .03, T .04—**6c** Each.

T .05—**7c** Each; T .1—**8c** Each.

T .25—**10½c** Each; T .5—**15c** Each.

N.U. THREAD MOUNT ALUMINUM CAN TYPE SC

National Union Type SC-SCN-SCS Upright Aluminum Can Condensers. With pal nut mounting. Flexible insulated leads. Individually cartoned in green N.U. boxes. Save over half on this. One-year guarantee.

SC 4 MFD.	450 Volt	1⅜x3½"	25c
SC 8 MFD.	450 Volt	1⅜x3½"	30c
SC12 MFD.	450 Volt	1⅜x3½"	35c
SC16 MFD.	450 Volt	1⅜x3½"	40c
SC20 MFD.	450 Volt	1⅜x3½"	45c
SC30 MFD.	450 Volt	1⅜x3½"	50c
SC40 MFD.	450 Volt	1⅜x3½"	55c
SC 8 MFD.	525 Volt	1⅜x3½"	50c
SC16 MFD.	525 Volt	1⅜x3½"	60c
SC 4 MFD.	600 Volt	1⅜x3½"	35c
SC 8 MFD.	600 Volt	1⅜x3½"	60c
SC12 MFD.	600 Volt	1⅜x3½"	70c
SC16 MFD.	600 Volt	1⅜x3½"	80c

SCN—DUAL—COMMON NEG.

SCN 8-8 MFD.	450 Volt	1⅜x3½"	50c
SCN 8-16 MFD.	450 Volt	1⅜x3½"	55c
SCN16-16 MFD.	450 Volt	1⅜x3½"	60c
SCN20-20 MFD.	450 Volt	1⅜x3½"	70c

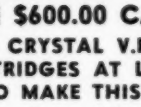
SCS DUAL FOUR LEADS

SCS 8-8 MFD.	450 Volt	1⅜x3½"	50c
SCS 8-16 MFD.	450 Volt	1⅜x3½"	55c
SCS16-16 MFD.	450 Volt	1⅜x3½"	60c
SCS20-20 MFD.	450 Volt	1⅜x3½"	70c

NATIONAL UNION ALUMINUM CAN "TWIST TAB" TYPE TT

National Union Type TT Electrolytic Condensers. Aluminum can F.P. type Twist Tab mounting common negative grounded to can. Individually cartoned in green N.U. boxes. Each condenser supplied with 1 bakelite insulating plate and 1 metal grounding plate. Save over half on these. All sizes and one-year guarantee.

TT 100 MFD.	25 Volt	1x2-1/16"		19c
TT 250 MFD.	25 Volt	1x2-1/16"		19c
TT 500 MFD.	25 Volt	1x2-9/16"		19c
TT 10 MFD.	450 Volt	1x2-1/16"		25c
TT 20 MFD.	450 Volt	1x2-1/16"		30c
TT 30 MFD.	450 Volt	1x3⅛"		40c
TT 40 MFD.	450 Volt	1x3⅛"		50c
TT 80 MFD.	450 Volt	1⅜x3"		60c
TT 20-20 MFD.	150 Volt	1x2-1/16"		30c
TT 30-30 MFD.	150 Volt	1x2-1/16"		35c
TT 40-20 MFD.	150 Volt	1x2-1/16"		35c
TT 40-40 MFD.	150 Volt	1x2-1/16"		40c
TT 50-30 MFD.	150 Volt	1x2-1/16"		45c
TT 50-50 MFD.	150 Volt	1x2-1/16"		50c
TT 80-40 MFD.	150 Volt	1x3⅛"		60c
TT 10-10 MFD.	450 Volt	1x2-1/16"		40c
TT 16-16 MFD.	450 Volt	1x3⅛"		45c
TT 20-20 MFD.	450 Volt	1x3⅛"		50c
TT 40-40 MFD.	450 Volt	1⅜x3"		60c
TT 16-16-16 MFD.	450 Volt	1⅜x3"		65c
TT 20-20-20 MFD.	450 Volt	1⅜x3"		65c
TT 20-20 MFD.	150 Volt 100 MFD.	25 Volt	1x2-1/16"	45c
TT 40-40 MFD.	150 Volt 25 MFD.	25 Volt	1x2-9/16"	40c
TT 20-20-40 MFD.	150 Volt		1x2-9/16"	50c
TT 40-40-40 MFD.	150 Volt		1x2-9/16"	60c
TT 40-40-40 MFD.	150 Volt		1x3⅛"	60c
TT 50-50 MFD.	150 Volt 25 MFD.	25 Volt	1x2-9/16"	50c
TT 80-40 MFD.	150 Volt 25 MFD.	25 Volt	1x3⅛"	60c
TT 10-10 MFD.	450 Volt 20 MFD.	25 Volt	1x3⅛"	50c
TT 10-10-10 MFD.	450 Volt		1x3¼"	60c
TT 10-10-10 MFD.	450 Volt 20 MFD.	25 Volt	1⅜x2"	70c
TT 10-10-10-10 MFD.	450V		1⅜x2"	70c



100 N.U. SAV-A-SHAFT $29.95

National Union Sav-A-Shaft Volume Controls. A regular **$1.25** list item all individually cartoned with instructions. Every size Control is equipped with an off-on switch which may be used by pulling small tab. These Controls are handy as most of you radio service men know. For replacement merely saw off old Volume Control Shaft and drive into the National Union Sav-A-Shaft coupling. Pick the sizes you want at these dollar saving prices or just order one hundred, as we assort them for only **$29.95.**

NU 5M-A	5,000 OHM	24c
NU 10M-B	10,000 OHM	24c
NU 25M-A	25,000 OHM	24c
NU 50M-B	50,000 OHM	29c
NU 100M-B	100,000 OHM	29c
NU 250M-TX	250,000 OHM Tapped	29c
NU 500M-TX	500,000 OHM Tapped	39c

MALLORY CLARASTAT STACKPOLE—Chicago Telephone Manufacturers Stock Controls. 10,000, 25,000, 100,000, 500,000 Ohms—**29c** Each, Less Switch.

500,000 DPST Switch, 3" Shaft—**49c.**

500,000 1 Meg., 2 Meg., SPST Switch, 2" Knurl Shaft, **39c.** 10 for **$3.50.**

1 Meg. and 2 Meg. 2" Knurl Shaft and SPST Switches tapped, **39c** Each. 10 for **$3.50.**

NU 1 MEG-TX	1 MEG OHM Tapped 39c
NU 2 MEG-TX	2 MEG OHM Tapped 39c
NU-500M-CB	500,000 OHM 39c

100 National Union Controls **$29.95.** Assorted as follows: 25 of the 1st 3 Types, 25 of the 2nd 3 Types, and 50 of the last 4 Types.

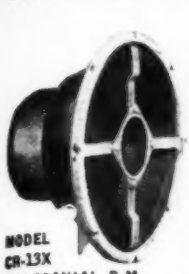
McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance C.O.D. With Parcel Post Orders, Include Postage

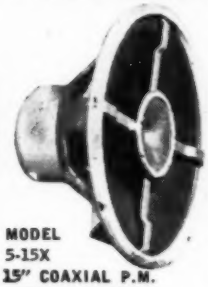
NOW AT OUR NEW AND LARGER QUARTERS

1422 GRAND AVE., KANSAS CITY, MISSOURI

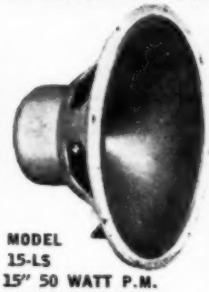
THE FINEST IN "WIDE RANGE SPEAKERS" ARE AVAILABLE AT McGEE



MODEL CR-13X
12" COAXIAL P.M.
$12.95



MODEL 5-15X
15" COAXIAL P.M.
$24.95



MODEL 15-LS
15" 50 WATT P.M.
$16.95

MODEL 15-KR
15" JUKE BOX
$9.95

MODEL A-50
12" 50 WATT P.M.
$14.95

DELUXE 12" COAXIAL MODEL CR-13X $12.95

- RESPONSE 40 TO 17,000 C.P.S.
- FINE CONSTRUCTION
- GREY FINISH
- REGULAR $32.50 LIST

Newly designed by one of America's finest speaker builders. Made for FM and AM high fidelity radios and record players. This speaker is incorporated in radios of the 500 dollar bracket. It has an especially designed 12" 6.8 oz. Alnico V Magnet PM for the low range Woofer and a coaxially built in 3" Alnico V tweeter for the extended high range. The high pass filter is concealed under the pot cover. Just hook to any 8 Ohm output transformer. Will work in place of any home radio speaker as most speakers have an 8 Ohm Voice Coil, only 2 wires to connect. Will handle 18 Watts peak. Wide range response 40 to 17,000 Cycles. This speaker should sell for $35.00. Why buy any ordinary speaker when we offer a 12" Coaxial PM for only $12.95. Shipping weight 8 lbs. **Model CR-13X, $12.95.** Two for.....**$24.95**

STANDARD 12" COAXIAL P.M. CN-12X $10.95

Standard Model 12" Coaxial PM Model CN-12X. Same as model CR-13X except 4.64 oz. Mag. in woofer response 50 to 17,000 CPS. Will handle 12 Watts Output. Shipping weight 7 lbs. **Stock No. CN-12X, $10.95.** Two for.....**$20.95**

15" "KING COAX" P.M. SPEAKER $24.95
"IT WOOFS AS IT TWEETS"

The King Coax. A 21.5 oz. 15 inch Alnico V PM speaker with a built-in high frequency tweeter. Will respond to from 50 to 12,000 cycles. This is a ruggedly built speaker with a curvelenier one piece molded cone. Built-in high pass filter. Just hook to any 8 ohm output. Built by the maker of our ever popular 12 inch coax model CR-13X. This speaker has a retail list of over $60.00. We offer you our 5-15X 15 inch coax for only **$24.95.** Shipping weight 16 lbs.

15" DELUXE 50-WATT P.M. SPEAKER $16.95
WITH WIDE RANGE MOLDED CONE

Model 15-LS. 15" 21½ oz. Alnico V Magnet PM Speaker. Will take 35 watts with ease. Thousands of dollars were spent in building the fine tools to produce this speaker. The 8 ohm voice coil is 1½" in diameter and has been heat treated and plastic coated. Constructed to eliminate loose voice coils, wires and warping. Made by a renowned builder of fine speakers. Truly the King of juke box speakers. Shipping weight 14 lbs. Net Price **$16.95.** Two for.....**$32.95**

15" JUKE BOX P.M. SPEAKER $9.95

Model 15-KR—Pre-War or Post-War, you never bought a speaker like this for such a scoop price. Made by a nationally known builder of fine speakers. A full 15" 12½ oz. Alnico V magnet speaker of juke box quality. Has standard 8 ohm voice coil. Will take up to 18 watts average or 25 watts peak. Here is a speaker that will bring out those low notes. Latest 1948 production; not line through-outs. Every speaker is guaranteed new and perfect. We may not be able to continue this offer for long, so place your order now. Stock No. 15-KR. INCLUDE POSTAGE. Wt. 10 lbs. A **$35.00** value for only.....**$9.95**

50-WATT 12" SUPER HEAVY DUTY P.M. $14.95

Model A-50—12", 50 watt super heavy duty permanent magnet speaker. Has 1½" 8 ohm treated voice coil and one piece molded cone. Heavy half inch machined pot, with bolt secured 21 oz. Alnico V magnet. Frame is of heavy construction with metal pot cover. Finished in silver-grey enamel. This speaker is the best value possible today. Efficiency is two to three times that of ordinary speaker. Especially recommended for all public address systems and high quality home audio systems. Will handle 35 watts with ease and 50 watts peak or short lengths of time. Its retail value is $50.00. But, by our large purchase, we are able to offer it to you for only **$14.95.** Do not confuse this speaker with surplus merchandise. This is the latest production. Model A-50. Shipping weight 13 lbs. Net **$14.95,** 2 for.....**$29.00**

OUTPUT TRANSFORMER HIGH FIDELITY 20—20,000 C.P.S. SCOOP PRICE $6.95 EACH

6600 OHMS PLATE TO PLATE

Why pay $20.00 or $30.00 for an output? Supreme quality and high fidelity output transformer. Designed to match push-pull plates (2—6L6, 2—6V6, or 2—6AQ5) class AB, to 4-8-15-250 and 500 ohm; with 10% feedback winding. Housed in a compound filled case: 3⅞x4¼x3". Actual net weight, 6 lbs. If you want the best quality from your audio system, order this transformer. Response essentially flat from 20 to 20,000 cycles. We have tried several high fidelity outputs in our lab and find this to be the best value. Even though your amplifier only puts out 10 or 15 watts, this 34 watt job is what you should have. Connecting instructions are furnished. Stock No. A-403, shipping weight 8 lbs. Net price.....**$6.95**

10 Watt High Fidelity Output similar to above A-403, only for push-pull 50L6 tubes (4000 ohm plate to plate) to 3.2 or 8 ohm voice coil. A high fidelity amplifier diagram furnished for your convenience. Stock No. H-201. Weight 3 lbs. Net **$3.95**

CONSOLE BASS REFLEX SPEAKER BAFFLE $24.95

6 Cubic Foot Utility Base Reflex Speaker Baffle. Size 32x22x16. Heavy construction with reinforced pleasing lines. Celotex lining assures non-rattle reproduction. Finish is an attractive brown wrinkle paint. Chrome front trim. Specify when ordering whether for use with a 12"or 15" speaker. Weight 40 lbs. This is an ideal baffle for our deluxe Coaxial model CN-13X. Baffle Stock No. NA-12. Net **$24.95.** CN-13X 12" Coaxial PM Speaker and NA-12 Baffle both for **$34.95.** You will be pleased with the fine tone of this combination.

12" P.M. FOR UTILITY USE 5 P.M. SPEAKERS ONLY $22.50

Nationally known 12" 6.8 oz. Alnico V PM with 1" 8 ohm voice coil. Will take 15 watts. Grey finish. Our leading 12" speaker.
Stock No. CH-12. Net **$4.95.**
5 for.....**$22.50**
12" 12 Oz. Mag. Will Take 20 Watts.....**$8.95**
Super heavy duty 12" 12½ oz. Alnico V magnet PM with 1¼" with 8 ohm voice coil. This speaker is equal to 60 oz. of old type magnet. Will take 25 watt peak. Stock No. CH-13—**$8.95;** two for.....**$17.00**

CURVELENIER "WIDE RANGE SPEAKER LINE"
MOLDED HIGH FIDELITY CONES—6", 8" AND 12" SIZES

Designed to meet the ever-growing demand for finer reproduction of sound. Wide range 6 and 8 inch models offered for the first time. These speakers feature heavier moving parts assembly. One piece molded high fidelity curvelenier cones with .45 M.M. reinforcing dust buttons. This reinforcement adds to the high frequency response and overall speaker efficiency. Cone movement is piston-like with more unified action. All models have 1" diameter 8 ohm voice coils, with 6.8 oz. Alnico V magnets. Even ordinary radios will sound better with these speakers.

Model 6L-1. Wide range 6½" PM 12 Watt. Shipping weight 4 lbs., response 90 to 12,000 CPS, **$4.95.**

Model 8L-1. Wide range 8" PM 12 Watt. Shipping weight 5 lbs., response 70 to 12,000 CPS, **$5.95.**

Model 12L-1. Wide range 12" PM 12 Watt. Shipping weight 7 lbs., response 50 to 12,000 CPS, **$7.95.**

BUY COMPLETE AMPLIFIER KITS $6.95 UP

TM-4—5 WATT KIT $6.95

Kit Model TM-4. 5 Watt Amplifier Kit. Ideal for beginner construction. Has features of higher priced amplifiers. Inputs for phono pick up or mike. Compensation for the G.E. Variable Reluctance pick up. Push-pull output gives good tone quality. Output to 8 ohm Voice Coil. Variable tone control and fader control. Ready punched chassis. This makes a top quality AC-DC Audio Amplifier. Priced complete with tubes, diagram and photos. 2—50B5, 2—12AX7, plus selenium rectifier. Weight 3 lbs. Stock No. TM-4, **$6.95.** Crystal mike and utility desk stand $4.95 extra. TM-4 custom wired and tested $3.00 extra.

TM-8—8 WATT KIT $8.95

Kit Model TM-8. 8 Watt Amplifier Kit for utility use, record playing, or paging. Matched component parts. Ready punched chassis. Variable tone control. One control fades from mike to phono. Input compensation for G.E. Variable Reluctance pick up. Output matches 8 ohm Voice Coil. 75 Mill Power Transformer. Price includes tubes, diagram and photo. Push-pull 6AQ5, two 12AX7, plus rectifier. Kit Model TM-8. Weight 8 lbs. Net **$8.95.** Crystal mike and utility desk stand $4.95 extra. TM-8 custom wired and tested $3.00 extra.

TM-12—12 WATT KIT $10.95

Kit Model TM-12. 12 Watt Amplifier Kit. Ideal for a high quality record player as a P.A. System or recording amplifier. Matched component parts ready punched chassis. One control fades from phono to mike. Input compensation for G.E. Variable Reluctance pick up. Output matches 8 ohm Voice Coil. 100 Mill Power Transformer. Complete with tubes, diagram and photos. 2—6V6, 2—12AX7 and rectifier. Variable tone control. Model TM-12. Weight 10 lbs. Net **$10.95.** Crystal utility mike and desk stand $4.95 extra. TM-12 custom wired and tested $4.00 extra.

TM-20—20 WATT KIT $15.95

Kit Model TM-20. A high quality 20 Watt Audio Amplifier with 135 Mill Power Transformer and push-pull 6L6's. Inputs for mike or phono pickup. Compensation for G.E. Variable Reluctance pick up. Tone and fader controls. Has heavy duty universal output transformer, to match 4-8-16, 250, 500 Ohm. Ready punched chassis. Price includes tubes, diagram and photos. 2—6L6, 2—7N7, 7Z4. Frequency response 30 to 9,000 Cps. Kit Model TM-20. Weight 20 lbs. **Net $15.95.** TM-20 custom wired and tested $5.00 extra.

PUSH BUTTON TUNER KIT

Complete kit of parts to build a 5 station push button tuner for PA system and record players. Small chassis push button only no condenser gang. 456 I.F. Furnished with diagram and tubes 6BA6, 6BE6, 6AT6 (gets B and A voltage from your amp.). Stock No. **FA-3.** Weight 2 lbs. Net **$5.95**

$59.50 VALUE MUSICAL AMP. $24.95

8 watt Musical Amplifier, 4 tube AC transformer type. Proper gain for all instrument pickups. Housed in leatherette case with built-in 8" speaker. Gain and tone controls. Made by a large manufacturer, to sell for $59.50. Stock No. **XB-3.** Weight 25 lbs. Net Price..**$24.95**

GENERAL ELECTRIC AND WEBSTER VARIABLE RELUCTANCE

New Webster cartridge with removable permanent needle. Response is second to none. Offered with preamplifier (6sc7) ready wired and tested. A scoop at **$5.95** complete.

Webster M1-VR cartridge only, net..**$4.41**

New General Electric V. R. cartridge No. RPX-040, with removable needle. Net.....**$5.85**

General Electric V. R. cartridge RPX-041, for micro-groove records. Net....**$5.85**

Our 6sc7 type pre-amplifier with either PRX-040 or PRX-041 cartridge. Net **$7.95**

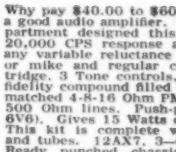
PHILCO MIKE SALE BRAND NEW WITH 20 FT. OF CABLE
$9.95 $14.95 $14.95

High imp. dynamic mike made for Philco. 20 ft. cable. Reg. **$26.00** list. Sale price **$9.95.** 3 for.....**$26.95**

High imp. dynamic mike made for Philco, 20 ft. cable. Reg. **$36.50** list. Sale price **$14.95.** 3 for.....**$41.95**

High imp. studio velocity. Made for Philco. 20 ft. cable. Reg. **$40.00** list. Sale price **$14.95.** 3 for.....**$41.95**

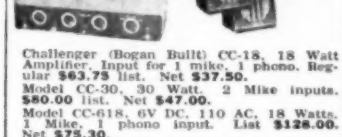
High imp. Cardyne dynamic (not pictured). Wide range response. 20 ft. cable. Regular **$59.50** list. Sale price.....**$24.95**



WIDE RANGE 20-20,000 CPS 15-WATT AMP KIT $24.95

Why pay $40.00 to $60.00 to buy parts for a good audio amplifier. Our engineering department designed this Kit to give 20 to 20,000 CPS response and have inputs for any variable reluctance pick up. FM tuner or mike and regular crystal pick up cartridge. 3 Tone controls, fader control, high fidelity compound filled output. Transformer matched 4-8-16 Ohm PM Speakers and 250-500 Ohm lines. Push-pull 6AQ5 (same as 6V6). Gives 15 Watts of wide range audio. This kit is complete with photo, diagram and tubes. 12AX7, 3—6C4, 2—6AQ5, 5Y3. Ready punched chassis. Everything furnished. Weight 16 lbs. Kit Model ME-15R. Net **$24.95.** Custom wired and tested **$10.00** extra. We recommend our CR-13X 12" Coaxial PM Speaker with this kit **$12.95.**

Kit Model ME-34R. Similar to Kit ME-15R except has 2—6L6 tubes in output giving 34 Watts Audio. Kit ME-34R **$34.95.** Weight 25 lbs. Custom wired and tested **$10.00** extra.



Challenger (Bogan Built) CC-18, 18 Watt Amplifier. Input for 1 mike, 1 phono. Regular **$63.75** list. Net **$37.50.**

Model CC-30, 30 Watt. 2 Mike inputs. **$80.00** list. Net **$47.00.**

Model CC-618, 6V DC, 110 AC, 18 Watts. 3 Mike, 1 phono input. List **$128.00.** Net **$75.30.**

12" Walnut Wall Baffles. Net **$4.95** Each. For PM Speaker see elsewhere on page.

University 25 Watt drive and PH horn. List **$54.00.** Net **$31.72.**

Write for Bogan Challenger and University laboratory circular.

McGEE HAS THE SPEAKERS

Following speakers listed are latest production No-Factory throwouts made by the largest factory who furnish the original equipment to America's biggest Radio Factory. Every speaker guaranteed.

3" PM 1 Oz. Alnico 5 Magnet.....**$0.99**
4" PM 1 Oz. Alnico 5 Magnet.....**.99**
4" PM 1½ Oz. Alnico 5 Magnet.....**1.19**
5" PM 1 Oz. Alnico 5 Magnet.....**.99**
5" PM 1½ Oz. Alnico 5 Magnet.....**1.19**
6" PM 1½ Oz. Aln. 5 Mag., Square **1.49**
6" PM 2.15 Oz. Aln. 5 Mag. Square **1.98**
6" PM 3.16 Oz. Aln. 5 Mag., Square **2.49**
6½" PM 1.5 Oz. Aln. 5 Mag., Round **1.69**
4x6" PM 1.5 Oz. Alnico 5 Magnet.. **1.49**
10" PM 4.64 Oz. Mag.....**3.98**

Hot Buys In PM's—With Trans.

4" PM 1 Oz. Aln. 5 2500 Ohm Trans.**$1.49**
4" PM 1 Oz. Aln. 5 10M Ohm Trans. **1.49**
5" PM 1 Oz. Aln. 5 2500 Ohm Trans. **1.69**
5" PM 1 Oz. Aln. 5 10M Ohm Trans. **1.69**
5½" PM 1 Oz. Aln. 5 2500 Ohm Trans.....**1.89**
6" PM 1.5 Oz. Aln. 5 7000 Ohm Trans.....**1.99**
6" PM 1.5 Oz. Aln. 5 2500 Ohm Trans.....**1.99**
6" PM 2.15 Oz. Aln. 5 7000 Ohm Trans.....**2.49**
6" PM 3.16 Oz. Aln. 5 10M Ohm Trans.....**2.98**

Hot Buys In Field Spkrs. With Trans.

5" 450 Ohm with 2500 Ohm Trans..**$1.98**
5" 450 Ohm with 7000 Ohm Trans.. **1.98**
6" 1500 Ohm with 7000 Ohm Trans. **2.29**
8" 450 Ohm with 7000 Ohm Trans.. **2.98**
8" 1000 Ohm, Less Trans.....**2.49**
10" 1000 Ohm, Less Trans.....**3.98**
12" 250 Ohm RCA, Less Trans.....**4.98**
12" 1000 Ohm Magnavox, Less Trns. **4.98**

Famous Magnavox Speakers

6" Auto Speaker—4 Ohm.....**$2.49**
7" Auto Speaker—4 Ohm..... **2.98**
8" Auto Speaker—4 Ohm..... **2.98**
5" 8 Oz. Alnico 3 PM..... **2.79**
8" 12 Oz. Alnico 3 PM..... **3.98**
10" 21 Oz. Alnico 3 PM..... **4.98**
12" 21 Oz. Alnico 3 PM..... **5.98**

Save Up To 50% On Cinaudagraph Field Coil Speakers

Regular Dealers Stock of field type Cinaudagraph Replacement speakers. Brand new, individually cartoned. Don't pass up this value.

3" 450 Ohm Field Cinaudagraph....**$1.79**
4" 4 Ohm Field (Auto) Cinaudagraph **1.79**
4" 450 Ohm Field Cinaudagraph.... **1.79**
5" 4 Ohm Field (Auto) Cinaudagraph **1.79**
6" 450 Ohm Field Cinaudagraph.... **1.99**
6" 1000 Ohm Field Cinaudagraph... **1.99**
8" 1000 Ohm Field Cinaudagraph... **2.49**

HOT ITEM—AUTO SPEAKERS

MAGNAVOX	UTAH
5" Square 4 OHM	$1.49
6½" Round 4 OHM	1.49
6x9" Auto Speaker 4 OHM	1.98
7" Motola-Philco	2.49
8" Motola-Philco	2.49

HEAVY DUTY AUTO P.M.s

Heavy duty PM speakers with ¾ inch voice coils and 3.16 oz. Alnico V magnet. Made by a top flight manufacturer this year for auto radio replacements.

6 inch 3.16 oz. Alnico V.P.M.....**$2.49**
6x9 inch 3.16 oz. Alnico V.P.M..... **2.98**
7 inch 3.16 oz. Alnico V.P.M..... **2.98**
8 inch 3.16 oz. Alnico V.P.M..... **2.98**

McGEE RADIO COMPANY

PRICES F.O.B. K.C. Send 25% with order. Bal. Sent C.O.D. With parcel post orders include postage.

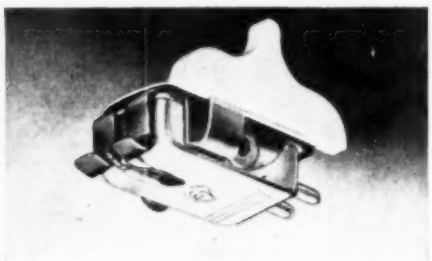
NOW AT OUR NEW AND LARGER QUARTERS 1422 GRAND AVE., KANSAS CITY, MISSOURI

What's New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

TWIN-TILT PICKUP CARTRIDGE

The "Twilt"—a new phono pickup cartridge for all three speeds—is announced by *Electro-Voice, Inc.*, Buchanan, Michigan. This single cartridge, with a single "Twin-Tip" replaceable needle, plays 78, 45 and 33⅓ r.p.m. records without weight change



and with a tracking pressure of only six grams on either needle-tip.

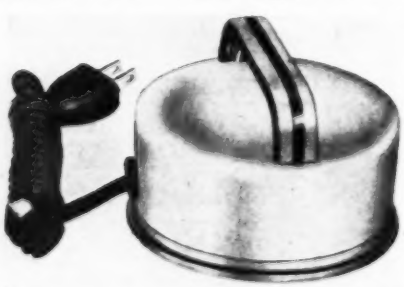
The twin-tilt cartridge mounts easily in any standard pickup arm—with no more adjustment required than reducing the needle pressure. Special silicone moistureproofing gives the crystal cartridge twenty times greater protection against humidity.

This cartridge is available in "Torque-Drive" crystal and variable "Magnetic" types, with replaceable twin-tip .001 sapphire and .003 osmium needles. The dimensions are 1⅛" wide and ¾" high, including tilt control lever. Length is 1½".

MAGNETIC TAPE ERASER

The Accessories Division of the *Amplifier Corp. of America*, 398-2 Broadway, New York 13, New York, is producing a new design called the "Magnerasor," which provides complete and instantaneous erasure of recorded reels of magnetic tape, without running the tape past the erase head. It will also effectively demagnetize erase and record playback heads when held in close proximity.

Measuring 4½ inches in diameter by 2 inches in height and weighing 2 pounds, the "Magnerasor" removes all normal and overloaded signal from all



types of recorded tape, with either plastic or paper base, and lowers the residual noise level as much as three to six db. below that of new, unused tape. The erase function is accomplished by placing it on the reel of magnetic tape and moving it around the circumference.

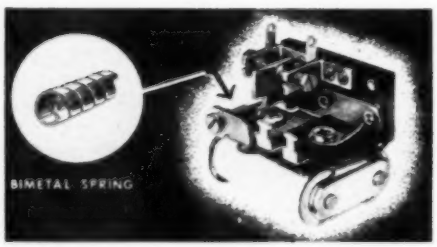
The housing, of turned aluminum, has a finger-fit handle, and the momentary control, push button "on-off" safety switch prevents the possibility of a.c. current being applied when the instrument is not in use. It operates on a line voltage of 100/130 volts and 25/60 cycles.

TEMPERATURE COMPENSATED RELAY

A relay recently developed by *Sigma Instruments, Inc.*, 45 Ceylon Street, Boston, Massachusetts, will give operation at constant voltage regardless of temperature, or at decreasing voltage with increasing temperature, according to the manufacturer.

Using a bimetal spring, this temperature compensated relay was developed for battery charge control where operating voltage must decrease with rising temperature. With 25 milliwatts operating power, voltage settings are stable to one percent, and windings are available for all common charging voltages.

This same construction also makes



available a new relay type giving operation at essentially constant voltage from −50° centigrade to + 85° centigrade. Adjustments are offered for voltages from .01 v. up, at sensitivities of 5 to 25 milliwatts.

TUBULAR TWIN LEAD

Under the catalogue number 14-271, *American Phenolic Corporation*, 1840 S. 54th Ave., Chicago 50, Ill., introduces a new twin lead for television and FM antenna lead-in applications.

The tubular shape of the 300-ohm *Amphenol* product provides security against deterioration caused in most cases of flat twin lead by collection of moisture or moisture and dirt on the polyethylene insulation. The tubular shape was designed to hold this moisture or dirt outside the concentrated field between the conductors. It also provides lower wind resistance than do some other types, and greater strength.

The conductors in the new twin lead are seven strands of #28 copper wire; the outside diameter is approximately 5/16". Any conventional coaxial cable type insulator may be used to support

it. The weatherproof features should make it very desirable for transmission line in cities where smoke is heavy, or along the seacoast where salt-bearing fogs are a problem.

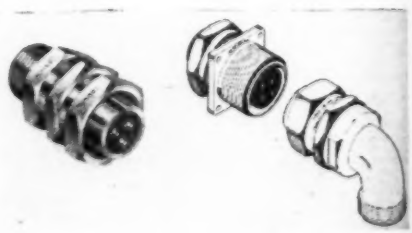
MINIATURE MICROPHONE

Altec Service Corporation, 161 Sixth Avenue, New York 13, N. Y., is the manufacturer of a new miniature microphone smaller than a stack of six dimes. The mike when in use is mounted on what resembles a conductor's baton.

This small, omnidirectional microphone, because of its inconspicuousness, was used exclusively in the annual presentation of awards by the Academy of Motion Picture Arts and Sciences last March 24. Throughout the ceremonies, the speakers were completely visible during the talks, and for newsreel sound and nationwide broadcasting.

VIBRATIONPROOF CONNECTORS

Radio shielding, pressurizing, and moistureproofing are new features of the Vibrationproof series of AN-type connectors, which have been completely redesigned by the manufacturer,



Cannon Electric Development Co., 3209 Humboldt St., Los Angeles 31, Calif.

The shell material is aluminum alloy with Dural coupling nuts; low millivolt drop contacts are copper alloy, silver plated. The series has been tested in actual aircraft operation, and radio shielding is accomplished

MONEY BACK GUARANTEE — We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check the design, calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.

THE NEW MODEL 247

TUBE TESTER

Check octals, loctals, bantam jr. peanuts, television miniatures, magic eye, hearing aids, thyratrons, the new type H.F. miniatures, etc.

Features:

- A newly designed element selector switch reduces the possibility of obsolescence to an absolute minimum.
- When checking Diode, Triode and Pentode sections of multi-purpose tubes, sections can be tested individually. A special isolating circuit allows each section to be tested as if it were in a separate envelope.
- The Model 247 provides a super-sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.
- One of the most important improvements, we believe, is the fact that the 4-position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

Model 247 comes complete with new speed-read chart. Comes housed in handsome hand-rubbed oak cabinet sloped for bench use. A slip-on portable hinged cover is indicated for outside use. Size: 10¾"x8¾" x5¾". ONLY..... **$29.90 NET**

THE NEW MODEL 670

SUPER METER

SUPER METER. A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS.

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500. **A.C. VOLTS:** 0 to 15/30/150/300/1500/3000 Volts. **OUTPUT VOLTS:** 0 to 15/30/150/300/1500/3000. **D.C. CURRENT:** 0 to 1.5/15/150 ma.; 0 to 1.5 Amps. **RESISTANCE:** 0 to 500/100,000 ohms, 0 to 10 Megohms. **CAPACITY:** .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics.) **REACTANCE:** 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms.

INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries.

DECIBELS: —10 to +18, +10 to +38, +30 to +58.

The model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3". **$28.40 NET**

The Model S-35—a POWERFUL

REFLEX PROJECTOR

COMPLETE WITH WESTERN ELECTRIC

BUILT-IN DRIVER UNIT

CONSERVATIVELY RATED AT 35 WATTS—WILL EASILY HANDLE UP to 55 WATTS WITHOUT BLASTING

Heavy gauge aluminum in the main trumpet section completely eliminates blasting and blaring. New plastic diaphragm overcomes the resonant peaks of the old type; also it is absolutely impervious to atmospheric changes whereas the old type was subject to atmospheric corrosion. Complete unit unconditionally guaranteed for one year.

Specifications:

POWER (CONSERVATIVE) — 35 WATTS; AIR COLUMN—3½ FT.; DISPERSION—80°; POWER (PEAK) —55 WATTS; BELL DIAMETER—15"; IMPEDANCE—8 ohms; FREQUENCY RANGE—130 to 5000 C.P.S.; PROJECTION—½ mile; FINISH — Attractive two tone crystalline. The Model S-35 Comes Complete with Built-in Driver Unit. ONLY.. **$28.50 NET**

SEE and HEAR the Signal with the new CA-12

SIGNAL TRACER

Features:

- Comparative intensity of the signal is read directly on the meter—Quality of the signal is heard in the speaker.
- Simple to operate. Only one connecting cable—No tuning controls.
- Highly sensitive—Uses an improved vacuum-tube voltmeter circuit.
- Tube and resistor capacity network are built into the detector probe.
- Built-in high gain amplifier—Alnico V speaker.
- Completely portable—Weighs 8 pounds—measures 5½" x 6½" x 9".

This model also available in Kit Form. All parts assembled ready for wiring. Order Model CA-12 Kit. Only.. **$21.95**

Complete with self-contained batteries and instructions..... **$29.95**

The New Model 770—An Accurate Pocket-Size

VOLT-OHM MILLIAMMETER

(Sensitivity: 1000 ohms per volt)

Features:

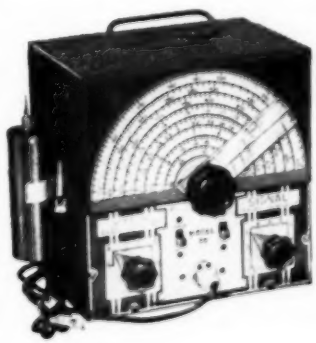
Compact measures 3⅛" x 5⅞" x 2¼". Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long life even with constant use.

Specifications: 6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 volts. **6 D.C. VOLTAGE RANGES:** 0-7½/15/75/150/750/1500 volts. **4 D.C. CURRENT RANGES:** 0-1½/15/150 Ma. 0-1½ Amps. **2 RESISTANCE RANGES:** 0-500 ohms, 0-1 Megohm.

The Model 770 comes complete with self-contained batteries, test leads and all operating instructions. **$13.90 NET**

The Model 88—A COMBINATION

SIGNAL GENERATOR AND SIGNAL TRACER



Signal Generator Specifications:

•Frequency Range: 150 Kilocycles to 50 Megacycles. •The R.F. Signal Frequency is kept completely constant at all output levels. •Modulation is accomplished by Grid-blocking action which is equally effective for alignment of amplitude and frequency modulation as well as for television receivers. •R.F. obtainable separately or modulated by the Audio Frequency.

Signal Tracer Specifications:

•Uses the new Sylvania 1N34 Germanium crystal Diode which combined with a resistance-capacity network provides a frequency range of 300 cycles to 50 Megacycles.

The Model 88 comes complete with all test leads and operating instructions. ONLY..... **$28.85 NET**

20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS

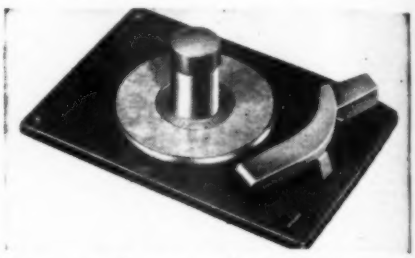
GENERAL ELECTRONIC DISTRIBUTING CO. DEPT. RN-6, 98 PARK PLACE, NEW YORK 7, N. Y.

by sphere and cone joints made in accordance with Navy Bulletin RE49A-501A. For insulating material, a new synthetic resilient material with high dielectric has been adopted that will function satisfactorily at −70 degees (F.) up to +390 degrees (F.).

For the time being, the new series will carry the prefix of an AN shell (such as 08 or 06) with the letters "AF" for a complete number, making the identification 08AF; when "AN Board" approval is granted, "AN" is expected to be added, as "AN08AF."

45 R.P.M. RECORD CHANGERS

One of the major producers of the new 45 r.p.m. record changers, *Crescent Industries, Inc.*, 4140 W. Belmont, Chicago, Illinois, is now turning out



the new 45 r.p.m. changers in quantity for manufacturers and soon hopes to make them available to distributors.

The company has stepped up its activity greatly in order to satisfy as much as possible of the demand for the new *RCA* development, and the record changers will be distributed through authorized *Crescent* distributors on a national basis.

SOLDERING PLIERS

The electric soldering pliers recently placed on the market by the *Durst Manufacturing Company*, 11110 Cumpston Street, North Hollywood, California, employ a current-resistance principle introducing a faster and more positive method of soldering.

They are designed for wiring and soldering and are especially adaptable to compact assemblies. The wires or parts to be soldered are held by the pliers, and the foot switch is depressed for an instant, heating the wires or part sufficiently to melt the solder. The current-resistance principle em-

ployed heats the work only at the point of contact, and the instantaneous heat requires no tinning, heat elements, or tips; the pliers are always cool.

These pliers do the combined work of standard pliers plus a soldering

(*Continued on page* 125)

Surplus CLEARANCE Sale!

DYNAMOTOR D-2

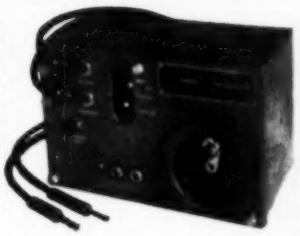
D-2 Converts to 110 V AC in ten minutes, diagram included, contains integral gear box having four ¼" drive shafts turning simultaneously at the following speeds:
4000 RPM—Grinders, buffers, flexible shaft tools, etc.
150 RPM—Wrapping fishing rods, slow speed tools.
25 RPM—Dev. tray rocker for photo darkroom.
5 RPM—Turning barbecue spits. Adv. Disp. Beams. A Thousand Other Uses Around the Work Shop. **$7.95** ONLY

DYNAMOTOR D-1

D-1 Converts to 110 V AC in ten minutes, diagram included, has shaft with squirrel cage blower, also gear reducer with 2 shafts and pulleys at the other end. 1001 uses. **$6.95** NEW

RM-29 PORTABLE FIELD TELEPHONE

An ideal portable field telephone. Complete in a rugged steel case for years of wear. Ringer circuit and **TS-13 handset.** No leather case to deteriorate. Compact 5"x6"x9"—also used as remote control on SCR-284. Simple two wire operation. 15 miles distance and upwards. Can be used for television installation, intercom system, construction companies outside and inside work, etc. Light weight, 13 lbs. Excellent condition.



SPECIAL LOW PRICE EACH..**$9.95** 2 for **$18.95**

BC-727 INDICATOR BOX
With two red jewel pilot light assemblies. It's a steal! Each **29c**

HEADSETS!
HS-23 High Impedance, HS-33 Low Impedance, Army Air Force Type, cord and plug.
HS-30 Low New **$1.59** Used **98c**

MIKE ADAPTER
M-299 for SCR-522 permits use of carbon mike in place of magnetic.
New Each **$2.50**

BC-733 D
A 10-tube superhet receiver for lateral blind landing guidance (CAA type certificate) TC-1045. Excellent condition 108-110 MC. Tube complement: 1—12SQ7; 2—12SR7; 1—12A6; 1—12AH7GT; 2—12SG7; 3—717A—tubes alone worth more than this low price.
SCHEMATIC FURNISHED Each **$5.95**

AN/CRW—2 V.H.F. RECEIVER
6 tubes: 3—6SL7, 1—6SN7, 1—6SG7, 1—6J5 Dynamotor, plug-in coils and sensitive relays. This was one of the Army's "Secret" V.H.F. remote control receivers. Operating at about 110 MC. A thousand and one uses. Like new in a metal case. Each **$5.95**

COMPLETE BEAM ROTATOR ASSEMBLY LP-21A AND I-82A
A large 5" indicator 1-82A, and an LP-21 loop (removed from aircraft). A complete perfect beam rotator system with indicator. Loop is low impedance—contains selsyn transmitter, etc.
Loop alone....**$5.95** Indicator alone....**$4.25** **$7.95**

WAFER SWITCHES
10 assorted, rotary, gang. Removed from equipment. ALL 10 for **$1.00**

LIP MIKE & CORD SET
MC-419 lip mike with cord CD-318 or CD-508, with PL-68, JK-48 and switch.
New **$1.59**

HOOK-UP WIRE
Approx. 400 ft. assorted gauges and colors—about 2 to 4 ft. length. **98c**

CORD CD-605 OR 604
A two foot cord with a PL-55 plug; with low to high impedance transformer for your headset. Will match HS-30 **39c**

CORD 307
A six foot head set extension cord with PL-55 plug on one end and a jack on the other. NEW. **59c**

ANTENNA LOADING UNIT
MC 432 contains 2 pole, 5 position rotary switch with silver ceramic variable condensers, and coils for matching VHF transmitter to AN 109 antenna with 50 ohm line. Useful parts. New Each **$1.39**

TOGGLE SWITCH
S.P.D.T. luminous tip bat handle.
NEW. 4 for **$1.00**

SLIDE SWITCH
S.P.D.T. designed for portables, etc. 10 for **$1.00**

AUTOMATIC RECORD CHANGER
Play 10" or 12" records. Special purchase Stewart-Warner Strobosonic.
Each only **$12.95**

6" PM SPEAKER
Beautiful new stock. Alnico magnet. Each **$1.95**

TRACEOMETER HICKOK
Ideal for the radio service man. Design for accurate general testing. Good condition.
Voltage measure, tracing, etc. Ea. **$79.95**

RELAYS
24 V. { S.P.S.T. / D.P.S.T. 160 ohms 4 for **$1.00**

MODULATOR UNIT
BC 456. Each **$2.95**

ANTENNA RELAY UNIT
BC 442 010 RF Amp. Meter, change-over unit for use with Command Set Transmitter. Brand New Each **$1.95**

BC-433G
15-tube superhet radio compass receiver 200 to 1750 Kc; CW-tone-voice. Like new. Similar to R5/ARN7.
Schematics furnished Only **$24.95**

GIBSON GIRL
Emergency transmitter balloon, kit, generator, case, etc. New **$12.95**

COMMAND SETS
BC-454—Receiver
3-6 M.C. Used. Good condition. **$7.95**

BC 457 TRANSMITTER
4-5.3 MC. Can be converted to 80 meters with slight modification. Ea. **$9.95**

BC 458 TRANSMITTER.
5-7 MC. Command Set **$9.95**

PULSE AND SWEEP GENERATOR. Each **$72.95**

MALLORY SWITCH
6 Pole 3 position single deck wafer switch. Each **39c**

TU 10B
Tuning unit for BC-375 . . . a terrific parts value with a metal case. Brand New. See page 24 Nov. Radio Craft for conversion to 10 meter final. Without case. **$2.10**
Only **$2.95**

TUBES

1625...3 for **$1.10**		5BP1 Scope tubes @	**$2.50**
6V6.....@	**.49**	5BP4 Scope tubes @	**3.45**
3D6.....@	**.49**	35Z5 ..... @	**.59**

BC-1206
Beacon Receiver 200 to 400 K.C.'s 28V plate and filament. Easily converted to broadcast band by adjusting of slug and tuned coils.
Each **$7.45**

T-17 D MIKE
The desirable single button carbon mike. With press the button to talk switch, 4' cord and PL-68 plug, mike cover.
Features non-echo effect. New **$2.49**

FILAMENT TRANSFORMERS
Fully shielded Pri. 100 V. Sec. (#1 winding 10.2 V @ 5 A. C. T.; #2 winding 10.2 V @ 10 A. C. T.) Secondary winding can be connected in series to supply 25 V. with a line Voltage of 115 Volts—60 Cyc. New Each **$3.75**

30 FT. CABLE
CO-213 7 Conductor cable with outside shield. Length of 30 ft. **98c**

DM-53A DYNAMOTOR
24V. in., 220V—80 M.A. out. USED Good condition. **98c**

MICRO SWITCH
Control box with long leaf type S.P.S.T. normally open switch. NEW **39c**

INVERTERS
PE 109
12V input for radio compass. 115V. 400 cyc. output. Used. Good condition. **$29.95**

PE 218
Input 25-28 VDC—92 amp. output 115 V. 350-500 cycles. 1500 Volt amp. Used, Good Condition. **$19.95**

PE 206
Input 28 VDC—38 amps. Output 80 V. 800 cycles, 500 Volt amps. Used. **$8.95**

MAST SECTION
MS-51 Mast section. New **50c**

PLUGS and CONNECTORS
YOUR CHOICE for only each **49c**

For the SCR-522.....PLQ-167, PL-172
For the BC-348.....PLQ-103
For the BC-733.....PLQ-254
For 269-F Radio Compass Inverter, PL-3108-22-48
For the SCR-274-N
...PL-147, 148, 151, 152, 153, 154A, 156, 258
For the BC-375.....PL-59—PL-61—PL-64
For the ART-13.....U-8U, U-10U, U-16U
For the ARC-1.....U-15U, U-16U
MC-203A coupling Coax Fittings—
.....PL-259A (83-1SP)-UG-21U-UG-22U

PL-164	M-359	U-11/U
AN-3108-28-19P		
AN-3108-12S / AN-3100-12S-33	Combination Male and Female	
PL-63	SO-44	PL-62
PL-56	SO-86	

6 VOLT MOTOR
A real beauty, removed from aircraft. Type used for auto fan. Each **98c**

BC-1066-A
IDEAL V.H.F. RECEIVER FOR THE HAM! This battery operated set is contained in a beautiful black telephone finished wooden cabinet 8"x 8"x14": 1-1D8GT Tube; 2-UT-237 Acorn tubes; 2 large airplane knobs, switches, variable condensers. This set can be converted to an ideal 2-meter transceiver for portable use. NEW **$10.95**

RADIO CONTROL BOX BC-450
Used for remote tuning and operation of command receivers. Has three independent units in one, each consisting of dial crank, volume control, C.W. Phone switch, female power connector and phone jack. Used—excellent condition. Each **$2.95**

INTERPHONE CONTROL BOX BC-606
Contains volume control, mike and phone jacks, switch, metal case, valuable parts. NEW **59c**

CONTROL BOX
Useful parts—2 S.P.S.T. toggle switches, wafer switch and knob, Sockets, Jack. **59c**

BC-312 DIAL KNOB ASSEMBLY 25c each

MINIMUM ORDER $2.00. ALL PRICES FOB CHICAGO. 20% Deposit required on all COD orders. Price subject to change without notice.

NESCORP ELECTRONICS Division of NATIONAL EQUIPMENT & SUPPLY CO., INC.
2635 W. Grand Ave., Dept. R Phone EVerglade 4-5870 Chicago 12, Illinois

AFCA NEWS

This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance and operation of communications and electronic equipment for Army, Navy and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Further details may be obtained by addressing the secretary at 1624 Eye St. N.W., Washington 6, D. C.

AFCA Third Annual Meeting

The third annual meeting of the Armed Forces Communications Association was held under Navy sponsorship at Washington, D. C., on March 28th and 29th.

The directors' meeting and chapter representatives' meeting were held in the morning of March 28th. The AFCA luncheon was addressed by Capt. A. A. Burke, U.S.N., and Mr. Wayne Coy, Chairman, Federal Communications Commission. At the general business meeting in the afternoon, the annual report of the association was presented, and honor awards were announced. The speakers were: Leighton H. Peebles, NSRB Assistant Director of Production; Major General Spencer B. Akin, Chief Signal Officer of the Army; Major General Francis L. Ankenbrandt, Director of Air Force Communications; Rear Admiral Earl E. Stone, Chief of Naval Communications; Fred R. Lack, President-elect of AFCA; and Capt. Robert J. Foley, Office of the Chief of Naval Communications, who briefed the members on the Navy demonstration scheduled for the following day. At the conclusion of the business meeting, the color film, "The Secret Land," was shown.

At the annual banquet, Dwight R. G. Palmer, President of *General Cable Corporation,* served as toastmaster. Addresses were made by Brig. General David Sarnoff, President of AFCA and Chairman of the Board of *RCA,* and Vice Admiral John D. Price, Deputy Chief of Naval Operations for Air.

The second day of the convention, March 29th, was devoted entirely to Navy exhibits. These included a visit to the USS *Requin,* the radar picket submarine which was moored at the Naval Gun Factory, to acquaint the Association with a type of submarine currently under the development and evaluation process, and a tour of the USS *Adirondack,* called an "Amphibious Force Flagship."

At the Naval Air Station, advanced models of experimental aircraft from the Naval Air Test Center at Patuxent River, Md., were flown past the spectators at low altitude, and there was a demonstration of Marine Corps piloted helicopters from Quantico, Virginia. In addition, exhibits were visited at the Naval Research Laboratory and the Naval Photographic Center.

The newly elected national officers of AFCA, who will take office on July 1, 1949, are as follows: President—Fred R. Lack of *Western Electric Company,* New York; Vice-Presidents—Theodore S. Gary of *Automatic Electric Company,* Chicago; Thomas J. Hargrave, *Eastman Kodak Company,* Rochester; Rear Admiral Earl E. Stone, USN; J. R. Cunningham, *United Air Lines,* Denver; and C. O. Bickelhaupt, *American Telephone & Telegraph Co.,* New York. New directors are: Walter Evans, *Westinghouse Electric Company,* Baltimore; Paul Goldsborough, *TWA,* Kansas City; and W. G. Eaton, civilian scientist at *Wright Field,* Dayton. W. C. Henry of the *Ohio Independent Telephone Co.* was elected Executive Committee member-at-large.

CHAPTER NOTES

Cleveland

The Cleveland Lifeboat station of the United States Coast Guard was the scene of the April 14th meeting of the Cleveland Chapter. The meeting was devoted to an inspection of communication facilities and electronic applications, including radio beacons and remote control facilities, as used in the varied services furnished by the Coast Guard.

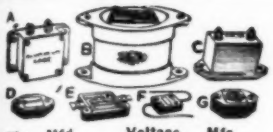
Kentucky

The March meeting of the Kentucky Chapter was held at the Lexington Signal Depot Officers' Club on March 11th. After the business meeting, a "white elephant" auction was held to replenish the chapter treasury. The program concluded with the Signal Corps picture, "Attack, Battle for New Britain."

The April meeting was held in the lobby of the new Lexington Telephone Company Building. Chapter President Murray P. McQuown reported on the AFCA Third Annual Convention which he had attended in Washington, D. C. The feature of the evening was the *Lexington Telephone Company* demonstration of the new dial system.

Louisiana

The charter of the Louisiana Chapter, newest AFCA chapter, was presented by Rear Admiral Earl E. Stone, Chief of Naval Communications, at a



H. V. MICAS SEND FOR LISTS OF OTHERS

Fig.	Mfd.	Voltage	Mfg.	Price
D	.01	1200WVDC	Aer.	$.50 2 For $0.95
E	.00025	2500TVDC	Spra.	.29 2 For .55
D	.00004	2500WVDC	Micamold.	.39 2 For .75
D	.000047	2500WVDC	Micamold.	.39 2 For .75
D	.0001	2500WVDC	Micamold.	.25 2 For .45
D	.01	500WVDC	C.D.	1.05 2 For 2.00
C	.002	3000WVDC	C.D.	1.50 2 For 2.90
C	.01	2000WVDC	Sang.	.49 2 For .95
C	.00003	2000WVDC	Spra.	.75 2 For 1.45
C	.00009	3000WVDC	Sang.	1.00 2 For 1.95
C	.00082	3000WVDC	C.D.	1.00 2 For 1.95
C	.002	3000WVDC	C.D.	1.65 2 For 3.25
C	.005	5000WVDC	Sang.	1.50 2 For 2.95
C	.0004	6000WVDC	Spra.	1.00 2 For 1.95
C	.0006	3000WVDC	Spra.	.95 2 For 1.85
C	.0008	3000WVDC	Sang.	.65 2 For 1.25
E	.0016	3000WVDC	Sang.	.40 2 For .75
E	.00090	3000WVDC	Sang.	10.00 2 For 19.00
B	.08	1500VDC	Sang.	12.00 2 For 23.00
B	.03	2000VDC	Sang.	12.00 2 For 23.00
B	.045	2000VDC	Sang.	24.00 2 For 47.00
B	.00015	20000VDC	Sang.	24.00 2 For 47.00
B	.0001	20000VDC	Sang.	19.00 2 For 37.00
B	.002	15000VDC	Sang.	1.45 2 For 2.85
C	.006	2500VDC	Micamold.	.35 2 For .63
E	.00027	2500WVDC		

WRITE FOR LISTS OF OTHER VALUES

BAND PASS FILTER

#70473. 8sharp band pass peaked at 700 cps. Band-width: 650 cycles at 20 db. Down from peak. High-to-high impedance. Can be plugged into 'phone output of receiver for good results. Cuts out QRM New, with circuit diagram $1.50

NAVY LINE FILTER. G.E. 100 amp filter with 2x5 mfd 50V oil filled cond. Operates 110VAC DC. **SPECIAL.** Price $1.98

CARBON PILE VOLTAGE REGULATORS

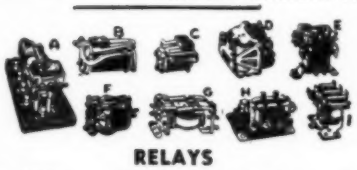
Type "A": Coil current .105 to .115 amp. 80 volts, Leland Electric $2.95

Type "C" Input: 22-30 v. coil, 30 amps. Output: 19 v. 5.7 amps. Spec. # VR9000-2c. Leland Electric (as shown) $2.95

#35X045B: 22v. .1 to 3 amps, for K-4B Gunsight, Webster .. $2.95

TRANSTAT (AMERTRAN)

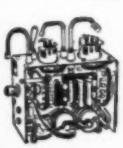
INPUT: 0.115v. 50-60 cy. Max. OUTPUT: 115v. 100 Amp. All units NEW. Guaranteed. Price $95



RELAYS

Type	Contacts	Rating	Res. Coil	Mfg.	Price
H	DPDT	24-28VDC	170~	GE	$1.75
H	SPDT	28VDC	175~	GE	1.25
H	3PDT	24-28VDC	1750~	GE	1.75
H	4PST	24VDC	180~	GE	1.75
G	DPDT/SPST (NO)	12VDC	44~	Leach	1.45
G	DPDT	22-28VDC	160~	Leach	1.25
D	SPST(NO)	28VDC	250~	Allied	1.39
I	DPST(NO)	14VDC	85~	Price	1.50
D	3PDT	24-28VDC	2800~	Allied	2.50
H	SPST	24-28VDC	2400~	GM	2.00
D	DPDT	24VDC	280~	Allied	2.00
D	3PDT	26VDC	280~	Allied	1.10
D	DPDT	28VDC	280~	Allied	2.10
D	SPST(NC)	75MA	60~	Allied	1.10
H	DPDT	20-30VDC		Dunce	2.00
H	DPDT	10-14VDC		Dunce	2.00
H	DPDT	24-28VDC		P.B.	1.75
H	3PDT	24-28VDC		GE	2.00
H	SPDT	24-28VDC		GE	1.75
A	DPDT	12VDC		Dunce	2.40
A	SPDT	10-12V 60Cy 125		Dunce	2.40

Send for Lists of Other Types



FREQ MULT UNIT

ART-13 Xmfr Assy. 2 to 18 Mc. Doubling Package setup, for two 1625 Tubes. No coils. Complete Assy. Less tubes w/ckt Diagram. . . . Price $8.95

UTC #60399—Audio Xfrmr 1:1 Ratio 50,000 ohm imp. 3 db. ± 1db. 50-3000 cy. OUNCER . . . Price . . 98c

ARC 9466—Mod. Xfrmr 807 to Par. 807S Class "C" . . . . . Price $1.65

UNIVERSAL OUTPUT XFRMR—Amer. Silicor. Pri.: 20000/16000/5000/4000/ohms. Sec.: 500/15/7.5/5/3.75/1.25/ohms. 3 db. Flat to 17000 cy $4.75

MOD INPUT XFRMR—T202, 6V6 Pl to 811 Grids for ART 13 (M7472064) $1.49

SEND FOR LISTS OF AUDIO EQUIPMENT

COMMUNICATIONS EQUIPMENT COMPANY — for your needs

WRITE FOR BLUE FLYER

3" OSCILLOSCOPE KIT

BC 929 Indicator using 9 Tubes, 3BP1, 6SN7, 6H6, 6B6G, 6X5, 2X2 (now 400 cycles) easily conv. to 60CY. 115V. New—Complete w/Tubes and conver. instr. incl. Dia. $22.50

5" OSCILLOSCOPE KIT

BC 704 (less pwr. supply) uses 8 Tubes—5BP1, 6AC7, 6H6, includes wooden Carry Case, Diag. and Tubes. Price $30.50

3BP1	$2.25	5CP1	$3.75
3DP1	2.25	5FP7	3.50
5BP1	1.95	2X2	.69
5BP4	4.95	6L6GA	1.00

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115V60CycInput
Plate & Fil Xfmrs.
Equip. Conservatively Rated

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F——; 2.5VCT/6.5A	3.25
F——; 6.3VCT/2A, 6.3VCT/2A	2.45
F5087; 6.3VCT/1A, 6.3VCT/7A	2.75
F5103; 6.3V/1A, 6.3V/1A	1.95
F5123; 6.3VCT/5A, 6.3V/1A	2.25
F5127; 6.3VCT/3.2A, 6.3VCT/1A	2.25
F0674; 8V/1.5A	2.75
F——; 2.5/1.75A, 6.5/8A, 5/3A, 6.5/.6	3.95
F7414; 2x2.5VCT/6.5A	3.25
F161; 6.3VCT/7A,6.3VCT/5A, 5VCT/6A, 2x6.3V/.6A, 6.3V/.3A	3.95
F829; 6V/2.5A	1.75
F38A; 6.3V/2.5A, 2x2.5V/7A	3.25
F112; 2x2.5VCT/6.5A, 2.5V/6.5A	4.25
F14A; 6.3V/6A	1.95

PLATE TRANSFORMERS

P410; 800VCT/40MA, 760VCT/500MA	$6.50
P415; 690V/450MA	4.95
P699; 2x300VCT/150MA	2.25
P403; 70V/1A	2.25
P413; 510VCT/150MA, 650VCT/15MA	3.00
P842; 660VCT/.016A, 250VCT/.07A	2.95
P885; 1620VCT/400MA HV ins.	11.95
P894; 2x200V/350MA, 2x20V/.01A	1.95
P450; 2x150V/940MA	4.50
P371; 246VCT/.820MA	3.95
P345; 1470VCT/1.2A 3500T	24.00

COMBINATION TRANSFORMERS

•C965; 780/600MA, 6.3V/2	$3.95
C111; 2x300V/42MA, 55V/125MA, 45V/3.5MA	3.95
•C608; 880VCT/150MA, 5V/3A, 6.3V/6.25A	4.25
C931; 585VCT/86MA, 5V/3A, 6.3V/6A	3.95
C055; 525VCT/75MA, 5V/2A, 6.3V/1.8A, 10V/2A	4.45
T102; 1080VCT/55MA, 6.3V/1.2A, 6.3V/1.2A	5.95
•C848; 600VCT/155MA, 6.3VCT/5A, 5VCT/3A, HV ins.	3.95
C899; 2x110VCT/.01A, 6.3V/1A, 2.5VCT/7A	4.50
C760; 6.3VCT/10A, 65V/.1A, 100VCT/.1A, 40V/.1A, 18VCT/.1A, 18V, 6V/.1A, 6.3V/.1A	5.25
C354; 825VCT/190MA, 5VCT/3A	3.95
C367; 5VCT/3A, 580VCT/.040A	2.95
T160; 1120VCT/770MA, 590VCT/.082A HV ins.	12.50
C579; 24V/900MA, 770V/.0025, 2.5V/3A HV ins.	4.25
T378; 2360V/.004A, 2.5V/2A HV ins.	8.95
C375; 1120VDC/600MA, 2x5VCT/6-2A, 6.3VCT/3A, 6.3V/300MA	14.95
C364; 6.3VCT/3A, 5VCT/6A, 610VCT/330MA	4.50
C434; 40V/.01A, 6.3V/1.25A	1.95
C383; 215VCT/300MA, 5VCT/6A	2.29
C360; 640VCT/.080A, 5VCT/3A, 6.3VCT/3.2A	3.95
C821; 1500V/4MA, 6.3V/6A, 2.5V/1.75A, 3500 Test	6.95

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7HY/140MA, $1.60; Dual 2HY/100MA ..... .75
Dual 2.5HY/130MA,$1.25; .11GHY/150MA 4.25
.01HY/2.5A, $1.45; .35HY/350MA 7.25
Dual .5HY/380MA, $1.00; 5HY/40MA ..... .55
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30HY/20MA, 85c; 5HY/200MA 1.45
2.1HY/200MA, $1.20; 2x2.2HY/.55A 9.95
25HY/75MA, $1.10; 20HY/300MA 7.95
Dual .22HY/600MA, .44HY/400MA 1.75
.033HY/7A, $9.50; Dual 30HY/150MA 3.50
Dual 1.52HY/167MA, $2.49; Dual 2.2HY/550MA. 5.95
5HY/200MA, $1.49; 1.35HY/1.1A 4.95
12HY/100MA, $1.75; 1HY/100MA ..... .60
2x2.5HY/700MA, $6.95. Write for lists.

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BATHTUB CAPACITORS

Fig.	Mfd.	Voltage	Terminals	Price
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E	3X.1	400VDC	3 @	33c 4 For $1.29
C	.1	400VDC	2 @	20c 5 For 95c
C	2X.1	600VDC	3 @	29c 3 For 85c
E	.025	600VDC	2 @	18c 5 For 85c
A	2	400VDC	2 @	40c 2 For 75c
C	.1	600VDC	2 @	25c 4 For 95c
E	2X.25	600VDC	3 @	29c 3 For 85c
A	.5	1000VDC	2 @	45c 3 For $1.30
D	.1	600VDC	2 @	25c 4 For 95c
E	3X.1	600VDC	3 @	35c 3 For $1.00
E	.5	200VDC	2 @	20c 5 For 95c
C	.05	600VDC	2 @	21c 5 For $1.00
E	.5	600VDC	2 @	25c 4 For 95c
C	.5	120VDC	2 @	18c 5 For 85c
E	.1	600VDC	1 @	20c 5 For 95c
E	4	50VDC	2 @	25c 4 For 95c
E	1	400VDC	1 @	25c 4 For 95c
D	1	600VDC	2 @	30c 3 For 75c
C	3X.1	600VDC	3 @	33c 4 For $1.29
E	2X.25	400VDC	3 @	27c 4 For $1.05
D	.1	600VDC	2 @	25c 4 For 95c
D	2X.1	600VDC	3 @	29c 3 For 85c
D	.5	600VDC	1 @	20c 3 For 95c
E	2X.1	200VDC	2 @	20c 5 For 95c
C	.5	400VDC	1 @	20c 5 For 95c
E	1	100VDC	2 @	15c 7 For $1.00
A	.02	1500VDC	2 @	45c 2 For 85c
C	.5	600VDC	2 @	25c 4 For 95c
C	.5	200VDC	2 @	20c 5 For 95c
E	4	50VDC	2 @	30c 3 For 85c
E	.20	50VDC	2 @	25c 4 For 95c

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Can be used for A.C. and D.C. operation. Amperes .010, 3, 7, 10, 50, 100, 150. **SPECIAL.** Each . . . . . $ 1.45
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Permits Transfer of H.S. from Receiver. 4" x 4" WD x 2" D. Contains JK-33A, JK-34A, Toggle Sw. Lum. Tip. Pot 50,000Ω. Term Strip. A REAL BUY. PRICE $1.00

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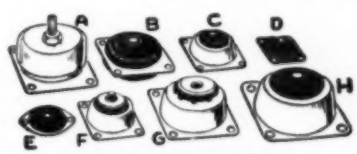
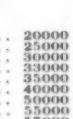


SHOCK MOUNTS

Fig.	Type	Size	Price
D	L# 1	1¼ x 1¼ x ⅜"H	10c
D	L# 6	1¼ x 1¼ x ⅝"H	10c
D	L# 5	1¼ x 1¼ x ⅝"H	10c
H	L# 15	1⅝ x 1⅝ x ⅝"H	15c
H	L# 12	1⅝ x 1⅝ x 9/16"H	15c
H	L# 35	2¼ x 2¼ x1" H	18c
G	U.S. # $150	2⅝ x 2⅝ x1⅛" H	55c
F	L# 4	1 23/32 x1 23/32 x1" H	35c

Many Other Types. Send for List.

932 PHOTOTUBE



A gas photo tube having S1 response. Sensitive to red & near infrared radiation. Can be used with incandescent light sources.
Anode Supply Volt. (DC or AC) . . . . . 90 Volts
Cathode Current . . . . . .3 Amp.
Ambient Temp. . . . . 100° C.
Sensitive at 8000 Angs. . . .0065 μAmp./μWatt
Luminous Sens. at Ocys. . .65 μAmp./Lumen
Price. $1.25; 2 For $2.25

PRECISION RESISTORS

1.01	125	1450	20000
3	128	1900	25000
5	150	2230	30000
5.05	200	4300	33000
10	250	5000	35000
10.1	300	7000	40000
18	430	7500	50000
43.5	468	8500	55000
50	800	10000	57000
75	920	12000	75000
82	1000	17000	We ship types
120	1100	17300	In stock

Above Sizes Each . . . . . 30c Ten For $2.50
100000 . . . . . 150000 . . . . . 200000 250000
120000 . . . . . 170000 . . . . . 220000 500000
Above Sizes Each . . . . . 40c Ten For $3.50

OTHER VALUES IN STOCK. SEND FOR LIST

luncheon meeting at the Jung Hotel, New Orleans, on March 15th. Admiral Stone said it was his personal opinion that the communications branches of the three services are leading all others in coordination under the unification of the armed forces. He described what is being done by the Joint Communications-Electronics Committee and declared that, as a result, the facilities of each service are being made more readily available to the other services. He cited the Berlin airlift as a good peacetime example of mutual support on the part of all three branches of the armed services. "It is truly an inspiring illustration of how two services—the Army and the Navy—can and are supporting the Air Force which is assigned the primary responsibility for accomplishing the task," he said.

The charter was presented to the interim president of the chapter, Harry B. Lackey, District Manager of the *Southern Bell Telephone & Telegraph Co.* Admiral Stone's speech was broadcast over a local radio station.

New York

The March meeting of the New York Chapter was held at the Officers' Club on Governors Island and commemorated the 86th anniversary of the Signal Corps. In honor of the occasion, the Chapter President, George P. Dixon, presented a pictorial history of the Signal Corps from its pre-Civil War days to and including World War II. The guest of honor was Maj. General Francis H. Lanahan, Commanding General at Fort Monmouth.

Philadelphia

The results of the annual election of officers for the Philadelphia Chapter have been announced as follows: W. W. Watts of *RCA Victor* was re-elected President; William H. Knowles of *International Resistance Co.* was elected 1st Vice-President; Leslie J. Woods of *Philco Corp.*, 2nd Vice-President; Joseph Bergman of the Signal Corps Stock Control Agency was re-elected Secretary; and W. F. Denkhaus of the *Bell Telephone Company of Pennsylvania* was re-elected Treasurer.

Pittsburgh

Chapter members attended a meeting of the Institute of Radio Engineers on March 14th at the Mellon Institute Auditorium. Mr. R. E. Stark, Vice-President of the *Stupakoff Ceramic & Manufacturing Company* (a group member of AFCA) spoke on "Ceramics That Talk."

Sacramento

The March meeting of the Sacramento Chapter featured a talk by Mr. Gordon A. Stevens of the *Eastman Kodak Company.* Mr. Stevens discussed the latest developments in high speed motion photography and the Di-transfer Process used in processing and printing color negatives. Prior to the meeting, chapter members and their guests from the Woodland Camera Forum of Woodland, California, and from the Sierra and Sacramento Signal Depot Clubs of Sacramento, reviewed an exhibit of aerial photographic equipment.

St. Louis

The St. Louis Chapter held a dinner meeting on March 21st in the Victoria Room of Garavelli's Restaurant. The *Southwestern Bell Telephone Company* furnished three sound movies for use at the meeting — "Trouble Underground," "The Telephone Hour," and "Stepping Along with Television."—30—

Bill Silverman, engineering student of Bronx, New York, alternates three months of study with three months of radio operating experience, scheduled over a two-year period. Aiming for a career as a radio-electronics engineer, Bill plans to specialize in marine equipment when he graduates and has chosen design as his field. As radio officer on the S.S. Marine Perch, he travels to Africa, England, and South America, while his classmates have to be content with less romantic jobs, and on top of all this experience and fun, he earns about $300.00 for each trip.

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2J33	24.95
2J34	24.95
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3B27	3.95
3B28	5.95
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3C22	18.95
3C23	4.95
3C24	.69
3C30	1.50
3CP1	3.00
3D21A	1.50
3DP1	3.95
3EP1	3.95
3E29	4.95
3FP7	3.95
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218	49.50
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252A	4.95
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274A/B	1.25
282A/B	9.95
290A	4.95
294A	4.95
294A	4.95
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304TH	6.95
304TL	1.49
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327A	4.95
338A	4.93
339A	24.95
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803	8.95
804	12.95
805	5.95
807	1.25
808	1.89
809	2.93
810	7.95
811	2.45
812	2.95
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813	8.95
814	3.95
815	2.95
816	1.19
826	.69
828	6.95
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830	2.95
830B	5.25
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836	1.15
837	2.50

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866A	.99
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874	2.49
878	2.49
884	1.49
885	.98
891	110.00
892	175.00
902P1	7.95
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923	.98
925	1.40
931A	4.95
950	.98
954	.75
955	.75
956	.75
957	.75
958A	.75
959	2.95
991	.75
1608	4.95
1611	.98
1613	.75
1614	1.75
1616	1.39
1619	.75
1620	4.95
1622	1.75
1624	1.75
1625	.49
1626	.49
1628	4.95
1629	.69
1631	1.50
1634	.79
1635	1.10
1636	5.95
1638	.98
1641	.79
1642	.98
1644	1.49
1851	1.25
1852	1.06
1853	1.06
1960	.95
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2051	.98
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RK34	.59
RK39	1.75
RK59	5.95
RK60	.79
RK65	24.95
RK73	1.95
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RX120	10.00
SD809	4.95
T20	1.50
T55	3.95
T200	10.95
TZ20	1.50
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V70D	6.95
VR75	.98
VR78	.75
VR90	.75
VR91	1.49
VR105	.98
VR150	.75
VT127A	3.00
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WL460	14.95
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ZP477/12DP8	14.95
0A2	1.69
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0B2	2.05
0B3/VR90	.75
0C3/VR105	.98
0D3/VR150	.75
0Y4	.88
0Z4	.88
OZ4G	.88
01A	.50
1A3	.72
1A4	1.28
1A4P	1.56
1A5GT	.72
1A6	1.28
1A7GT	.80
1B3GT	1.49
1B4	1.56
1B5/25S	1.28
1B7GT	1.06
1C5GT	.88
1C6	1.28
1C7G	1.28
1D5GP	1.55
1D7G	1.28
1D8GT	1.56
1E5GT	1.38
1E7G	1.56
1F4	1.06
1F5G	1.06
1F6	1.56
1F7G	1.56
1G4GT	1.06
1G6GT	1.06
1H4G	.88
1H5GT	.66
1H6G	1.28
1H6GT	1.28
1J6GT	1.28
1L4	.80
1LA4	1.06
1LA6	1.06
1LB4	1.06
1LC5	1.06
1LC6	1.06
1LD5	1.06
1LE3	1.06
1LG5	1.06
1LH4	1.06
1LN5	1.06
1N5GT	.80
1P5GT	1.06
1Q5GT	1.06
1R4	1.06
1R5	.80
1S4	.96
1S5	.72
1T4	.80
1T5GT	1.06
1U4	.80
1U5	.72
1V	.88
2A3	1.28
2A4G	1.28
2A5	.88
2A6	1.06
2A7	1.06
2B7	.88
2V3G	1.98
2X2A	1.25
3A4	.39

Type	Price
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3B7	.36
3D6	.36
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3Q4	.88
3Q5GT	.96
3S4	.80
3V4	.80
5AZ4	.50
5R4GY	1.15
5T4	1.28
5U4G	.60
5V4G	.96
5W4	1.06
5W4GT	.66
5X4G	.72
5Y3GT	.42
5Y4G	.60
5Z3	.72
5Z4	1.06
6A3	1.28
6A6	1.06
6A7	.80
6A8	.80
6A8GT	.80
6AB5/6N5	.88
6AB7/1853	1.06
6AC5GT	1.16
6AC7/1852	1.16
6AD6	.88
6AD7G	1.28
6AF6	1.25
6AG5	1.06
6AG7	1.28
6AH6	1.56
6AJ5	.99
6AK5	1.56
6AK6	.96
6AL5	.80
6AL7GT	1.06
6AQ5	.80
6AQ6	.72
6AQ7GT	.88
6AR5	.66
6AS7G	4.95
6AT6	.60
6AU6	.80
6AV6	.60
6B4G	1.28
6B5	1.56
6B6G	.88
6B7	1.28
6B8	1.28
6B8G	1.28
6BA6	.80
6BE6	.72
6BG6G	1.92
6BH6	.80
6BJ6	.80
6C4	.39
6C5	.66
6C5GT	.66
6C6	.80
6C7	1.28
6C8G	1.28
6D6	.66
6D8G	1.28
6E5	.85
6E6	1.06
6F5	.66
6F5GT	.66
6F6	.80
6F6GT	.66
6F7	1.06
6F8G	1.28
6G6G	1.06
6H6	.60
6H6GT	.60
6J5	.54
6J5GT	.54
6J6	1.16
6J7	.80
6J7GT	.80
6J8G	1.28
6K5GT	.96
6K6GT	.60
6K7	.66
6K7GT	.66
6K8	.96
6K8GT	.96
6L5G	1.06
6L6	1.42
6L6G	1.16
6L6GA	1.16
6L7	.96
6L7G	1.16
6N6G	1.56
6N7	.96
6N7GT	.96
6P5GT	.96
6Q6G	1.06
6Q7	.80
6Q7GT	.72
6R7	1.06
6R7GT	1.06
6S7	1.28
6S7G	1.28
6S8GT	1.06
6SA7	.66

Type	Price
6SA7GT	$ .66
6SB7Y	.88
6SC7	.72
6SD7GT	.49
6SF5	.66
6SF5GT	.72
6SF7	.80
6SG7	.80
6SH7	.39
6SJ7	.66
6SJ7GT	.66
6SK7	.66
6SK7GT	.66
6SL7GT	.96
6SN7GT	.88
6SQ7	.60
6SQ7GT	.60
6SR7	.72
6SR7GT	.72
6SS7	.66
6ST7	.88
6SV7	.88
6T7G	1.24
6U5G5	.72
6U6GT	.72
6U7G	.72
6V6	1.28
6V6GT	.80
6W7G	.88
6X4	.60
6X5GT	.60
6Y6G	.96
6Y7G	.88
6Z7G	1.28
6ZY5G	.88
7A4/XXL	.72
7A5	.72
7A6	.72
7A7	.72
7A8	.72
7AD7	1.06
7AF7	.72
7AG7	.88
7AH7	.88
7B4	.72
7B5	.72
7B6	.72
7B7	.72
7B8	.72
7C4/1203A	.39
7C5	.72
7C6	.72
7C7	.72
7E5/1201	1.66
7E6	.72
7E7	.88
7F7	.88
7F8	1.06
7G7/1232	1.06
7H7	.80
7J7	1.06
7K7	1.06
7L7	.88
7N7	.88
7Q7	.72
7R7	.88
7S7	1.06
7V7	1.06
7W7	1.06
7X7/XXFM	1.06
7Y4	.72
7Z4	.72
10	.69
12A	.60
12A6	.39
12A6GT	.29
12A7	1.28
12A8GT	.80
12AH7GT	.88
12AL5	.80
12AT6	.60
12AT7	1.16
12AU6	.80
12AU7	.96
12BA6	.72
12BE6	.72
12C8	.69
12F5GT	.72
12H6	.39
12J5GT	.39
12J7G	.80
12J7GT	.80
12K7GT	.66
12K8	.88
12K8GT	.96
12Q7GT	.72
12SA7	.66
12SA7GT	.66
12SC7	.72
12SF5	.80
12SF5GT	.80
12SF7	.80
12SF7GT	.80
12SG7	.72
12SH7	.39
12SJ7	.66
12SJ7GT	.66
12SK7	.66
12SK7GT	.66
12SL7GT	.88

Type	Price
12SN7GT	$ .80
12SQ7	.60
12SQ7GT	.60
12SR7	.39
12SR7GT	.39
12X3	.98
12Z3	.88
14A7/12B7	.88
14AF7/XXD	.88
14B6	.88
14B8	.88
14C5	.88
14C7	.88
14E6	.72
14E7	.88
14F7	.88
14F8	1.06
14H7	.88
14J7	1.06
14N7	1.06
14Q7	.88
14R7	.88
14S7	1.06
14W7	1.06
14X7	1.06
14X4	.88
19	1.28
19T8	1.56
22	1.28
24A	.88
25A6	1.06
25A6G	1.06
25AC5GT	1.16
25L6GT	.66
25Y5	1.16
25Z5	.60
25Z6GT	.60
26	.72
27	.60
28D7	.39
30	.89
31	.39
32	1.28
32L7GT	1.28
33	.39
34	.38
35/51	.80
35A5	.72
35B5	.80
35L6GT	.66
35W4	.46
35Y4	.72
35Z3	.72
35Z4GT	.60
35Z5GT	.50
36	.39
37	.39
38	.39
39/44	.39
41	.66
42	.66
43	.66
45	.66
45Z3	.60
45Z5GT	.72
46	1.06
47	.96
49	.88
50	1.56
50A5	.88
50B5	.66
50L6GT	.66
50Y6GT	.72
53	1.06
56	.72
57	.80
58	.80
59	1.06
70L7GT	1.56
71A	.80
75	.66
76	.66
77	.66
78	.66
79	.88
80	.46
81	1.56
82	1.06
83	1.06
83V	1.28
84/6Z4	.72
85	.88
89	.72
89Y	.39
117L7GT	1.56
117M7GT	1.56
117N7GT	1.56
117P7GT	1.56
117Z3	.60
117Z4GT	1.16
117Z6GT	.96
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voltage is obtained from a 4.5 mc. resonant circuit in the screen circuit of the tube and transferred to a 4.5 mc. amplifier, and from here to a ratio detector. Following this are two stages of audio amplification before the audio signal is fed to a loudspeaker.

Advantages of the Intercarrier System

Now that we have examined the underlying principles of the Intercarrier system and noted its application to commercial receivers, it might be well to evaluate its advantages and limitations. The greatest single advantage offered through the use of the Intercarrier system is its relative independence of many of the difficulties which beset the local oscillator and which affect the quality of the output in a conventional television receiver. Thus, consider what happens when the oscillator frequency drifts. In both systems, the resultant video and sound i.f. values will shift. Suppose that this shift is 200 kc. In a receiver employing the conventional television system, the video signal will be negligibly affected because 200 kc. is unimportant when compared to the total video spread of 4.0 mc. In the sound i.f. system, however, the discriminator linearity extends usually for ±100 kc. on either side of the i.f. carrier frequency and a shift of 200 kc. will remove the signal from the linear portion of the characteristic, distorting or causing the complete loss of audio output.

Compare this with the same effect in a receiver employing the Intercarrier system. Since separation of the two signals does not occur in the i.f. system, the only effect this produces is to shift the position of the two signals along the i.f. response curve. This will alter somewhat the amplification accorded these signals, but not to an appreciable extent since 200 kc. is negligible compared to the 4.5 mc. bandpass. When the two signals reach the video second detector, the resultant 4.5 mc. beat note will be obtained since the difference between the two carriers is fixed at the transmitter and nothing that occurs at the receiver can alter this relationship. The 4.5 mc. beat note will then pass through the video-frequency amplifiers and into the sound system unaltered by the local oscillator change in frequency.

Shifting of the local oscillator frequency due to hum or microphonics will likewise have negligible effect in the Intercarrier system because no matter how the oscillator frequency changes, the difference between the two carrier frequencies remains 4.5 mc. and it is from this difference that the sound output is obtained.

Fine-tuning controls are employed in conventional television receiver sets to counteract any drift of the oscillator frequency. Since oscillator drift—within nominal limits—does not appreciably affect the operation of a set using the Intercarrier system, this control may be dispensed with. However, several of the Intercarrier receivers on the market still include a fine-tuning control. With the control available, less precautions need be observed in designing the front-end tuning system, with resultant economy.

Another advantage offered by the Intercarrier system is a simplification of the design of the receiver. The number of stages in the sound i.f. system is reduced by two to three since the sound signal is first passed through all the video amplifiers before being transferred to the sound system. Furthermore, tolerances of the local oscillator are not critical, permitting the use of cheaper components, with less care required in the layout. In the i.f. system, the bandpass may be made symmetrical, as previously demonstrated, permitting the manufacturer

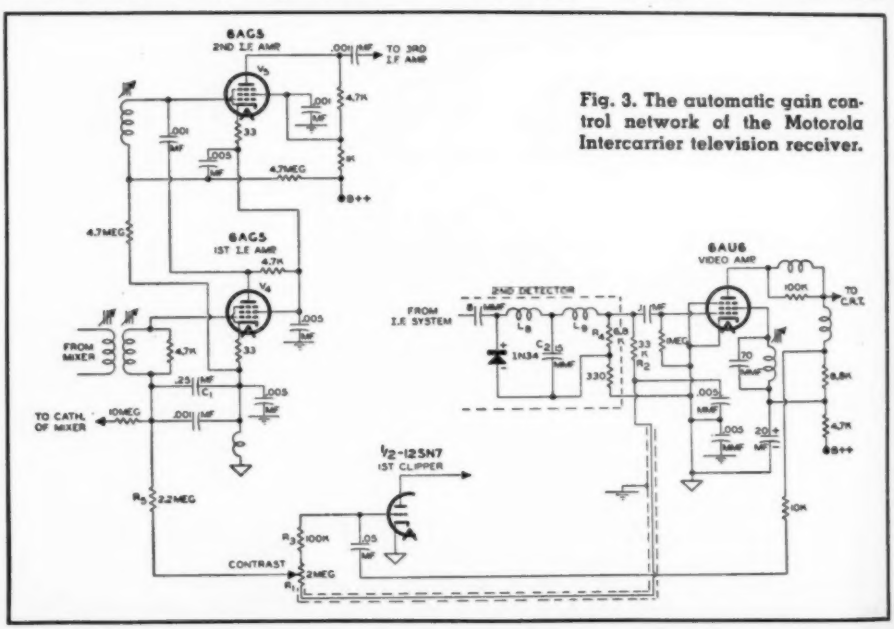

Fig. 3. The automatic gain control network of the Motorola Intercarrier television receiver.

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931A	3.95				
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1626	.45				
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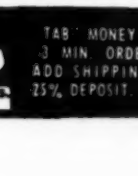

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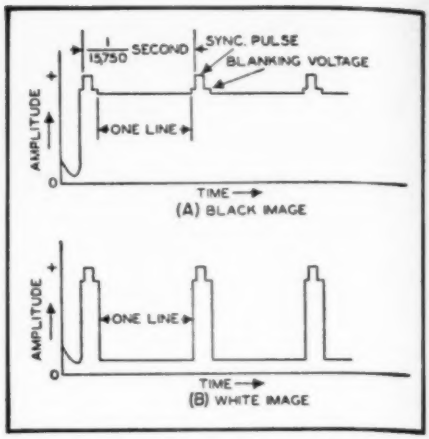

Fig. 4. The average voltage of a video signal varies with its modulation.

to design the oscillator so that it operates above the video and sound carriers on the lower television band and below these signals in the upper television band. Since it is cheaper to construct a stable low frequency oscillator than a stable high frequency oscillator, additional economy is possible. All these considerations point up the desirability of using the Intercarrier system.

Disadvantages of the Intercarrier System

The Intercarrier system is not without disadvantages, however. The appearance of the sound at the loudspeaker is dependent upon the mixing action that occurs in the video second detector. If something should happen to prevent the transmission of the video carrier—and this can and has happened—then no output at all is obtained at the receiver. Note that this is peculiar to Intercarrier systems and is not true in sets employing the conventional system. While it may be argued that the foregoing set of conditions seldom occur, yet there is another manifestation of this same effect that appears more frequently. Thus, when a white line or series of lines are being transmitted, the video level drops down to a very low value. See Fig. 4. If care is not observed at the transmitter, the level may easily drop to zero (corresponding to 100 per-cent modulation) resulting momentarily in no video signal. This causes the sound to disappear, also momentarily. This is usually repeated at line frequency (15,750 cycles) or field frequency (60 cycles) producing a 60 or 15,750 cycle buzz in the receiver. (The 60-cycle buzz is more evident because most people cannot detect a note as high as 15,750 cycles.) To prevent this, it is necessary to check carefully transmitter modulation. Current FCC regulations merely specify that the amplitude of the video carrier, when transmitting maximum white, may not be more than 15 per-cent of the maximum video carrier amplitude (which is attained when the sync pulses are sent). If this is amended to specify a definite minimum, say 10 per-cent,

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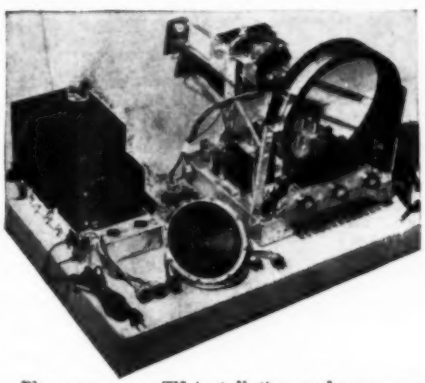

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then we would insure that the video carrier would never be lost.

Another factor that requires careful observance is the incidental phase or frequency modulation that sometimes develops in the video carrier when it is receiving the video intelligence. It has been found that under some circumstances the video carrier will receive a small amount of phase or frequency modulation while it is being amplitude modulated at the transmitter. In the subsequent mixing that occurs in the video second detector at the receiver, this phase or frequency modulation is passed on to the 4.5 mc. sound signal and is naturally not removed at the FM detector. The result again is a 60 cycle buzz or a 15,750 note.

Precautions are necessary in receivers, too. Here, the greatest single factor affecting proper operation is the relative magnitude of the video and sound carriers at the time they are mixed in the video detector. If the amplitude of the video carrier is very large compared to that of the sound carrier, then the amplitude of the beat note is very nearly independent of the amplitude of the video signal. This means that the FM 4.5 mc. beat note will not be affected by any modulation contained on the video carrier. Now, this stress on keeping the amplitude of the beat note as constant as possible rises chiefly because the FM detector and the limiter which precedes it are not insensitive to amplitude modulation when it appears in a sizeable amount. Most servicemen believe that an FM detector and limiter will not respond at all to amplitude modulation and this is true if the amplitude modulation is small. However, if it becomes large, then it will affect the output of the FM detector and distort whatever audio signal is present.

The value of 26 db. as the difference between the amplification accorded the video and sound i.f. carriers will insure that the 4.5 mc. beat note receives little amplitude modulation.

Finally, there is the problem of attempting to maintain the sound limiter and detector tuned circuits at precisely 4.5 mc. Any deviation from this value, due to altered components, usage, humidity, etc., will cause the sound signal to be displaced to a non-linear portion of the detector characteristic, thereby producing a distorted output. Nothing short of a complete re-alignment of these stages will correct this condition. In sets using the conventional system, this condition can be corrected by retuning the local oscillator using the fine-tuning control.

(To be continued)

ADDITIONAL NOTES ON AMPLIFIER FOR SOUND ON FILM CONVERSION

By ROBERT L. MUHS

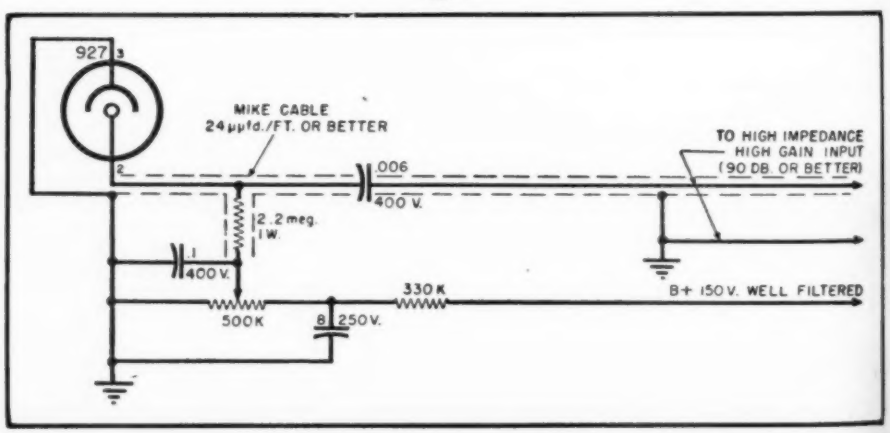
AFTER reading Mr. R. L. Newland's very short article on page 104 of the March Radio & Television News, entitled "Amplifier for Sound on Film Conversion," it occurred to me that a simplified circuit could be evolved.

If the amplifier used has a high impedance input and high gain (90 db. or more—such as for a velocity-type mike) a preamplifier stage is unnecessary, and the only requirements are that a photoelectric cell polarizing voltage be obtained from the amplifier "B plus" line and that the PEC signal be d.c. isolated from the amplifier input. The circuit (Fig. 1) covering these suggestions is somewhat simpler than Mr. Newland's.

Should a preamplifier be required, it can be mechanically independent of the projector mechanism. Connection to the PEC can be made by a good mike cable, preferably 24 $\mu\mu$fd./ft. or better. To further reduce microphonics, a 1620 tube, a 6J7, or a 6SJ7 (in order of preference) should be used. If rubber suspension of the tube socket is necessary, grommets above and below the chassis will isolate the socket well.

To simplify further, an a.c. exciter lamp at 60 cycles can be used without objectionable hum, provided the lamp is rated two amps or above. A four-or five-amp lamp is preferred because of the stronger signal to the PEC, but probably a separate transformer would be required. The only time hum is noticeable is when there is no film in the sound gate, and this can be taken care of with the volume control during the threading time. —W—

Fig. 1.



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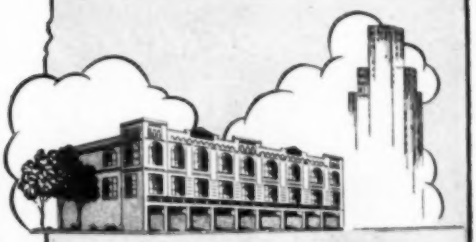

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MARS Station of the Month

W6USA Headquarters, Sixth Army, has grown into a key station. On the fifth of April, 1946, Major John Wilson, Jr., W4EUQ, operating fixed portable W6, worked W6WD on 75 phone. This was the first contact at W6USA. At that time, W6USA consisted of one BC-610 and one Super-Pro receiver. Today W6USA is housed in the penthouse on top of Building 35 in the Presidio of San Francisco and has four BC-610 transmitters, one SCR 640 transmitter, one *Hallicrafter* HT-18 (which allows use of NBFM), one VHF-152 and one SCR-639 receiver, and a SCR-211 frequency meter, oscilloscope, and Panadaptor, and uses crystal or v.f.o. on all bands, c.w. or phone. Antennas at present are doublets for 80, 40 and 20 meters, and a three-element beam on 10 meters. The two-meter antenna is a five-element fixed beam.

If you think this is a "ham's" paradise, just listen to the new projects already started! Two twenty-four-foot towers are being erected, one for a three-element roto beam on twenty, and the other for a four-element roto beam on ten. Both are electrically rotated and have remote direction indicators. A five-element, two-meter rotary beam and a four element, six-meter rotary beam are also in the process of construction.

Five new consoles with sloping panels will house a complete receiving position consisting of receiver, preselector, modulation and carrier level indicator, speaker, necessary change-over switches, key and mike jacks, and a phone patch, also separate jacks for remote line in case of emergency. Yes, Major Wilson would be surprised if he saw W6USA today, as would Colonel "Walt" Snyder and all the other officers and men whose cooperation made this possible.

W6USA has overseas schedules and is always ready to handle your traffic, maintaining operations from 0745 to 1630 PST and from 1700 to 2400 PST Monday through Friday. Every "ham" is welcome to "come up and see us some time." The visitors' book shows visits from every district as well as visitors from overseas and many SWL's.

W6USA is controlling station for MARS in the Sixth Army Area. The staff consists of SFC "Tony" Welzel (W2QC) Chief OP; M/Sgt "Robbie" Robinson (W6QIU); Sgt "Hank" Bowden (W6FHU); Cpl. "Whitey" Roen (license but no call); SFC "Randy" Arnold; SFC "Fred" Thourot, and Lt. Harold H. Haas, MARS Command Director, Sixth Army.

Call W6USA for traffic or just a rag chew.

—30—

Membership in the National Guard Military Amateur Radio Service is open to any Guardsman or recruit who possesses an amateur radio operator's license.
(See page 149 for details)

Left to right: Tony (Sgt. Anthony E. Welzel, Richmond, Calif., W2QC), Hank (Sgt. H. R. Bowdon, Mayfield, Kentucky, W6FHU), Whitey (Cpl. Clarence A. Roen, McLaughlin, South Dakota, no call, although he is licensed), and Randy Arnold, performing the normal duties of W6USA, 6th Army, in the penthouse station in San Francisco, Calif.

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up to 18v AC	up to	12v DC	15 Amp.	11.57
up to 18v AC	up to	12v DC	30 Amp.	22.57
up to 36v AC	up to	28v DC	1 Amp.	3.47
up to 36v AC	up to	28v DC	5 Amp.	8.57
up to 36v AC	up to	28v DC	10 Amp.	14.57
up to 36v AC	up to	28v DC	15 Amp.	22.27
up to 115v AC	up to	100v DC	.25 Amp.	2.57
up to 115v AC	up to	100v DC	.6 Amp.	5.27
up to 115v AC	up to	100v DC	5 Amp.	22.57
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.25mfd.	600v	.37	2mfd.	2000v	1.27
.5mfd.	600v	.37	4mfd.	2000v	3.77
1mfd.	600v	.37	8mfd.	2000v	3.47
2mfd.	600v	.37	15mfd.	2000v	4.97
4mfd.	600v	.57	4mfd.	2500v	3.97
8mfd.	600v	1.07	2mfd.	2500v	2.37
10mfd.	600v	1.17	.1mfd.	2500v	1.27
3x.1mfd.	1000v	.47	.25mfd.	2500v	1.47
.25mfd.	1000v	.47	.5mfd.	2500v	1.77
1mfd.	1000v	.57	.05mfd.	3000v	1.97
2mfd.	1000v	.67	.25mfd.	3000v	2.67
4mfd.	1000v	.87	1mfd.	3000v	2.87
8mfd.	1000v	1.97	12mfd.	3000v	6.97
10mfd.	1000v	2.07	2mfd.	4000v	4.87
15mfd.	1000v	2.27	1mfd.	5000v	4.97
20mfd.	1000v	2.97	.1mfd.	7000v	2.97
24mfd.	1500v	5.27	3mfd.	4000v	5.37
.1mfd.	1750v	.87	2mfd.	3000v	3.47
.1mfd.	2000v	.97	2x.1mfd.	7000v	3.27
.25mfd.	2000v	1.07	.02mfd.	12000v	9.97
.5mfd.	2000v	1.17			

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100 mfd.—50 WVDC..... .47
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1B32	1.97	805	3.87	1H5GT	.57
1N21	.67	807	1.07	1L4	.67
1N23	.77	808	1.57	1LC6	.87
1N34	1.37	809	2.47	1LD5	.77
1P24	.87	810	5.97	1LE3	.97
2AP1	3.27	811	1.97	1LH4	.77
2C21	.27	812	2.47	1LN5	.67
2C22	.17	813	6.47	1N5GT	.57
2C26A	.27	814	2.67	1R5	.67
2C34	.27	815	1.87	1S4	.67
2C40	3.57	816	1.07	1S5	.57
2C44	.77	826	.47	1T4	.57
2C46	6.87	829B	5.97	2A3	.97
2D21	1.07	830B	3.57	3A5	1.37
2J21	9.87	832A	4.57	3S4	.67
2J22	9.87	833A	29.97	3Q4	.67
2J26	9.87	836A	.97	3Q5	.67
2J48	19.97	837	1.27	5T4	.97
2J548	39.97	838	2.87	5U4G	.47
2K25	23.97	841	.47	5V4	.87
2K28	11.57	843	.37	5W4	.67
2V3G	.97	845	4.17	5X4	.67
2X2	.37	851	24.97	5Y3	.37
3AP1	3.97	860	1.87	5Y4	.47
3B22	2.97	861	10.47	5Z3	.47
3B24	1.87	862A	497.47	5Z4	.77
3B26	1.47	864	.47	6A7	.67
3BP1	1.37	865	.97	6A8GT	.67
3CP1	2.67	866A	1.17	6AB7	.77
3C21	3.97	866JR	1.17	6AC7	.77
3C23	2.47	869B	27.57	6AG5	.87
3C24/24G	.47	872A	1.47	6AG7	1.17
3C30	.37	874	.57	6AJ5	.87
3C31	1.47	876	.67	6AK5	.87
3D21A	1.47	878	1.27	6AK6	.87
3DP1	1.97	884	1.27	6AL5	.67
3E29	5.97	885	.77	6AQ5	.67
3GP1	4.97	902P1	4.97	6AQ6	.67
4AP10	2.97	905	1.87	6AT6	.47
4B24	2.27	923	.87	6AU6	.77
4E27	12.97	954	.27	6B4G	.97
5AP4	3.97	955	.37	6BG6G	1.97
5BP1	1.47	956	.37	6BE6	.67
5BP4	2.47	957	.27	6B8	.87
5CP1	1.97	958A	.27	6C4	.27
5CP1A	8.97	1613	.57	6C5	.47
5D21	34.97	1616	.87	6C6	.57
5FP7	1.37	1619	.27	6D6	.47
5JP2	11.97	1624	.77	6F6	.57
5LP1	13.97	1625	.37	6F7	.57
5NP1	8.97	1626	.37	6G6	.77
5R4GY	1.17	1629	.27	6H6	.47
6C21	24.97	1630	1.87	6J5	.47
6J4	5.87	1636	3.97	6J6	.87
9GP7	9.97	1638	1.47	6J7	.67
9JP1	3.57	1641	.57	6K6	.47
9LP7	3.57	1654	1.97	6K7	.57
10Y	.37	1851	.97	6L6	1.17
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28D7	.37	8012A	1.47	6SA7	.47
30 Spec.	.27	8013A	1.27	6SC7	.67
45 Spec.	.47	8016	.97	6SF5	.57
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100R	1.47	8025	3.57	6SH7	.47
100TH	9.97	9001	.37	6SJ7	.47
100TS	2.37	9002	.37	6SK7	.47
227A	2.97	9003	.37	6SL7	.57
249C	2.57	9004	.37	6SN7	.57
250R	9.97	9006	.27	6SQ7	.47
250TH	19.47	C6J	3.97	6V6GT	.67
250TL	19.47	CK507AX	1.47	6X5GT	.57
294A	4.97	CK1005	.27	6ZY5G	.87
304TH	3.47	CK1090	1.27	12A6	.17
304TL	.97	E1148	.67	12AT6	.57
305A	12.47	EF50	.47	12AU6GT	.57
307A	3.97	F123A	9.97	12C8	.37
316A	.67	F127A	17.97	12J5GT	.37
327A	2.97	F128A	39.47	12SA7GT	.57
350B	1.47	F660	39.47	12SK7GT	.57
368AS	3.27	F862A	497.47	12SG7GT	.57
371B	.97	FG17	2.87	12SH7GT	.57
378A	1.97	FG81A	3.97	12SL7GT	.67
434A	3.27	FG95	8.97	12SQ7GT	.57
446A	.67	FG105	9.97	12SR7GT	.57
450TH	18.47	GL697	29.47	14A7	.87
451	1.47	HY69	3.97	14Q7	.57
530	22.57	HY615	.37	24A	.67
531	4.97	ML100	19.97	25L6GT	.57
532	2.87	ML101	29.47	25Z5	.47
559	.87	ML502	39.47	27	.47
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703A	3.27	RK60	.57	35L6GT	.57
705A	1.97	RK72	1.37	35Z3	.57
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707B	8.47	RK75	3.97	45	.57
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6.3v @ 10A; 6.3v @ .6..... 2.97
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Transient Distortion

(*Continued from page 47*)

difficulty in securing effective feedback without incurring oscillation or instability. Usually a poor output transformer is blamed for this condition, but in the author's experience, several other factors are often of importance. The circuit shown in Fig. 2 is designed to operate with inexpensive, commercial-grade transformers, as many of these have a frequency response extending to above fifteen thousand cycles and are usable in circuits incorporating fifteen to twenty decibels of conventional feedback. The use of the bridge circuit raises the effective feedback to a much higher level; however, in any feedback circuit it is important to reduce stray capacities, inductances, and couplings to a minimum. Since in good operation, the feedback will extend up into the ultrasonic range, the effect of self-inductance in some types of paper condensers should not be neglected. Likewise, the resistive elements in the feedback loop should not be wirewound, if possible, especially the variable element of the bridge. Furthermore, the resistance of electrolytic condensers and ground returns may vary greatly at ultrasonic frequencies, and as a result it is often desirable to shunt electrolytics with small noninductive paper condensers and make firm ground connections to a copper busbar.

The phase shifting condensers shown in the diagram are C_3 and C_7. C_7 is placed across the primary of the output transformer and serves the secondary purpose of stabilizing the circuit to prevent ultrasonic oscillation. Condenser C_3 is incorporated in the variable feedback control which acts as a resistive portion of the phase shifting system and provides variable phase shift. As different speakers will have varying characteristics, various values of capacitance should be tried to best match the high-frequency characteristics of the speaker. Generally, this will mean a definite increase in high-frequency brilliance due to improved ability to handle complex waves and also an apparent actual increase in speaker efficiency due to a decrease in apparent speaker inertia. However, too much capacity should not be used in the phase-shifting network or excessive high-frequency boost will be obtained.

In adjusting the circuit, the feedback control should be advanced and the variable bridge element adjusted to the point where low-frequency oscillation takes place due to regeneration. The bridge is then adjusted to a point slightly beyond the place where the low-frequency oscillation ceases. This is the point where maximum feedback may be attained, and if the circuit is functioning properly, the feedback control may be advanced greatly before high-frequency oscillation oc-

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1C7G	3A4	6G6	12A8GT	25L6GT	50B5
1D5G	3Q4	6H6GT	12A6	25Z5	50L6GT
1D7	3S4	6J5GT	12A7	25Z6GT	56
1D8GT	5U4G	6J7GT	12AT6	26	57
1F4	5V4	6K6GT	12AU6	27	58
1F5G	5X4G	6K7GT	12C8	30	70L7GT
1G6GT	5Y3GT	6P5GT	12BA6	31	71A
1H4G	5Y4G	6Q7	12BE6	32L7GT	75
1H6GT	5Z3	6Q6GT	12F5	35	76
1J6G	6A7	6R7	12H6	35/51	78
7B6	6AC5GT	6SA7GT	12J5GT	35B5	81
7E6	6A3	6SC7GT	12J7GT	35C5	83
7C4	6A8GT	6SD7GT	12K7GT	35L6GT	84/6Z4
14X7	6AJ5	6SF5GT	12K8G	35W4	75
1B4	6AQ6	6SF7	12Q7GT	35Z5GT	112A
1C4	6AT6	6SG7GT	12SA7GT	37	89
1L4	6B6	6SH7	12SH7GT	37A	117Z3
1P5	6B7	6SJ7GT	12SG7	38	182B
1R5	6BA6	6SK7GT	12SJ7GT	39	183
1S4	6BE6	6SL7GT	12SK7GT	39/44	482B
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1T4	6C5GT	6SR7GT	12SQ7GT	41	
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6J6	6BG6G	6W7G	19T8
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1A7GT	1LH4	6L6G	7J7	117Z6GT
1G4GT	1LN5	6U5	7N7	24A
1H5GT	1N5GT	7A4	7Q7	35Z4GT
1J6G	1Q5GT	7A7	7S7	807
1LA4	2A3	7E5	7W7	

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40-40 mfd, 150V	ea. 49c
50-30 mfd, 150V	ea. 57c
50-50 mfd, 150V	ea. 49c
15 mfd, 150V	ea. 19c
16 mfd, 150V	ea. 23c
20 mfd, 150V	ea. 25c
30 mfd, 150V	ea. 29c
40 mfd, 150V	ea. 29c
8-8 mfd, 450V	ea. 43c
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20-20 mfd, 450V	ea. 49c
8 mfd, 450V	ea. 24c
10 mfd, 450V	ea. 29c
10 mfd, 450V with 20-20 mfd, 25V	ea. 39c
15 mfd, 450V	ea. 29c
20 mfd, 450V	ea. 39c
30 mfd, 450V	ea. 49c
30 mfd, 450V with 20-20 mfd, 25V	ea. 59c
10 mfd, 25V	ea. 17c
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curs. This oscillation usually occurs at one of the speaker's higher resonant points and is preceded by a "ringing" sensation on high pitched tones. By carefully adjusting the bridge circuit, excessive hangover may be achieved in the low frequencies, if desired, due to regeneration.

As mentioned before, results obtainable with this type of circuit are very good, but as with any other type of equipment will depend to a large degree on careful construction and the quality of the associated components. It should be realized, however, that musical tastes may differ widely, and an excellent amplifier speaker combination is not necessarily a guarantee of a high degree of listening pleasure. In many musical selections there is very little real bass and the elimination of "synthetic" bass produced by low-frequency resonance may appear to the listener as lack of lower register in the equipment. Of course, bass boost may be used, but this tends to distort the proper reproduction of harmonic structures. In addition, faults originating in the accessory equipment such as tuners, pickups, and recordings may be emphasized.

In judging the performance of a reproducing system, one of the simplest methods is to use a microphone of good quality and observe the ability of the system to reproduce different sounds naturally. This method tends to eliminate outside sources of distortion such as might occur in a recording or radio broadcast, and the constructor has the advantage of having the original sound for direct comparison. As moving coil, dynamic microphones may be subject to transient distortions similar to those found in loudspeakers, the author prefers to use a good-quality crystal for maximum clarity. The human voice is a good test of a system's capabilities, as it covers a wide frequency range and may have very pronounced transients. However, do not be misled by speech mannerisms into assuming there is good reproduction, as these mannerisms may give the effect of naturalness even though the reproduction is quite distorted. The author has found that by using systems with superior transient response, the effect of poor acoustics is greatly diminished, and good pickup may be achieved at a distance from the microphone.

It is becoming increasingly evident that conventional distortion measurements are, for the most part, inadequate in judging the actual performance of audio equipment, and many audio men are beginning to rely on the ear as the final arbiter in sound reproduction. In the author's experience, up to twenty per-cent harmonic distortion may be tolerated in musical reproduction, provided the transient distortions produced in the loudspeaker by the resultant steep wave fronts are held to a low value. Likewise, fairly large amounts of intermodulation distortion, when achieved by means other than overloading the amplifier, are tolerable and may add a definite quality to the reproduction. Both of these distortions have a definite relation to the sounds being reproduced; however, transient distortion often means excessive distortion at one or more frequencies, and the resulting discontinuity can be very objectionable, especially in the higher register. As a result, there is often a very good reason for the frequency attenuation found in many systems and the various listening practices condemned by the exponent of wide-range reproduction. In cases of really good, wide-range systems employing binaural reproduction, the reproduction may be superior to the original because of the apparent ideal position of the listener and through the enhancement of instrument quality by added amplification.

—30—

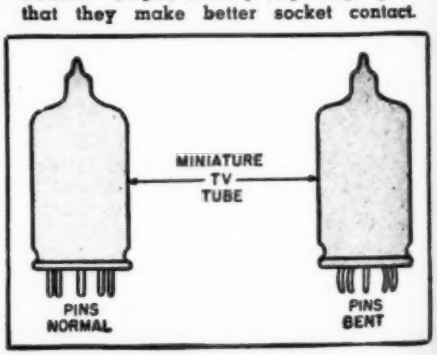
CURING MINIATURE TUBE CONTACT TROUBLES

By MATTHEW MANDL

THE base prongs of the miniature tubes used in television receivers are made of tempered metal and are subject to oxidation. If the tube socket does not exert too strong a grip on the prongs of the tube, electrical contact may be intermittent or lost entirely A common result of this condition is an intermittent picture on the television screen. Streaks across the picture, or complete loss of picture may also result.

An offending tube of this type can usually be found by placing the finger over the doubtful tube and moving it back and forth slightly in the socket. If this makes the condition either better or worse, the tube should be removed and the prongs scraped clean with a small knife blade Fine sandpaper can also be used to remove the oxidized coating. After replacing the tube in the socket again check to see if the condition is still present. If the trouble persists, the tube socket may have to be replaced, inasmuch as it obviously is not gripping the tube sufficiently Often however, the situation can be remedied without socket replacement by giving a slight bend to the tube prongs with a thin-nose pliers. This will, in effect, increase the contacting surface area of the prongs and make them fit tighter into the socket holes. —30—

(Left) Normal tube with straight prongs which due to oxidation may in time cause trouble. (Right) Bend prongs slightly so that they make better socket contact.



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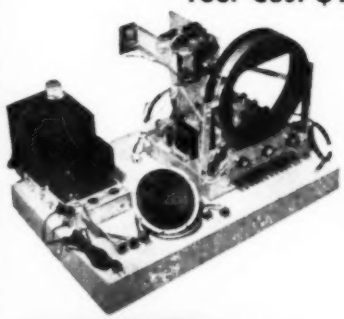

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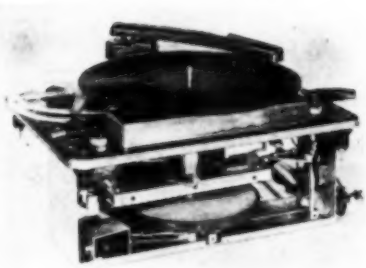

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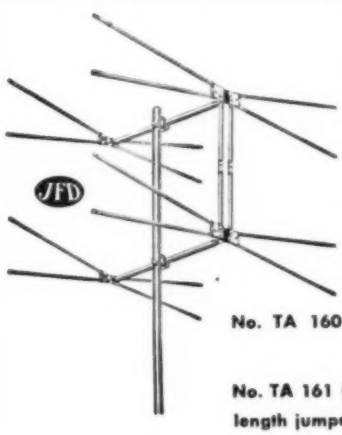

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Super-modulated Rig
(*Continued from page 52*)

connected solidly to the chassis at *each* of their ends.

Jacks J_1, J_3, and J_4 and the eight insulated power supply binding posts are mounted along the rear lip of the chassis (Fig. 1, left). The a.c. power cord supplying the two filament transformers enters a grommet-lined hole just below jack J_1. The 6.3 volt filament transformers (T_3 and T_4) are mounted under the chassis close together in the right-rear corner. The pilot light bracket is mounted near the center of the front lip of the chassis. Clearance holes (See Fig. 3) are drilled to pass the terminals of transformer T_2. A similar transformer of different construction might be provided with wire leads. Fixed condensers, C_{11} and C_{13}, are mounted on top of the chassis near the final tank variable condenser and tank coil with which they are associated. All other condensers are below chassis.

The final tank coils posed something of a problem. The 100 $\mu\mu$fd. per-section tuning condenser (C_{12}) was chosen for high C and good flywheel action in this circuit. To work with this capacitance, the coils need to be somewhat small in inductance. We could find no small, manufactured plug-in coils (in the 75-watt category) having *both* center taps and end links. The problem was solved simply, however, by putting our own center taps on *Barker & Williamson* Type JEL end-lined coils. There is one unused contact on the ceramic five-pin plugs of these coils which conveniently accommodates the center tap lead. However, it becomes necessary to use the *B. & W.* 40-meter coil for 80-meter operation, the 10-meter coil for 20-meter operation, and a special coil which must be wound for 10 meters. The special coil is air-wound with No. 14 or 16 tinned copper wire and consists of 4 turns, 1½" in diameter, spaced to a winding length of 2 inches. Tap the second turn. The link winding is 2 turns of the same wire airwound to the same diameter and supported not more than ¼" from the "cold" end of the main coil. The final tank coils plug into a five-prong ceramic socket mounted on ceramic standoff insulators near tuning condenser C_{12}. (See Fig. 1.)

Tuning condenser C_{12}, being rotor-grounded to the chassis, is mounted on short metal pillars as close as possible to the coil socket.

Two uncased $\mu\mu$fd. condensers were used for C_{15}, C_{17}, and C_{18} mainly because of the small size of these large-capacitance units. (Note: electrolytic condensers cannot be employed in these positions.) These condensers, which are 3¼"x1⅞"x⅞" in size, are mounted under the chassis by means of metal bracket straps under transformer T_2. They are not shown in Fig. 3, since they hide much of the wir-

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RADIO TEST INSTRUMENTS

by Rufus P. Turner
Consulting Engineer, RADIO NEWS

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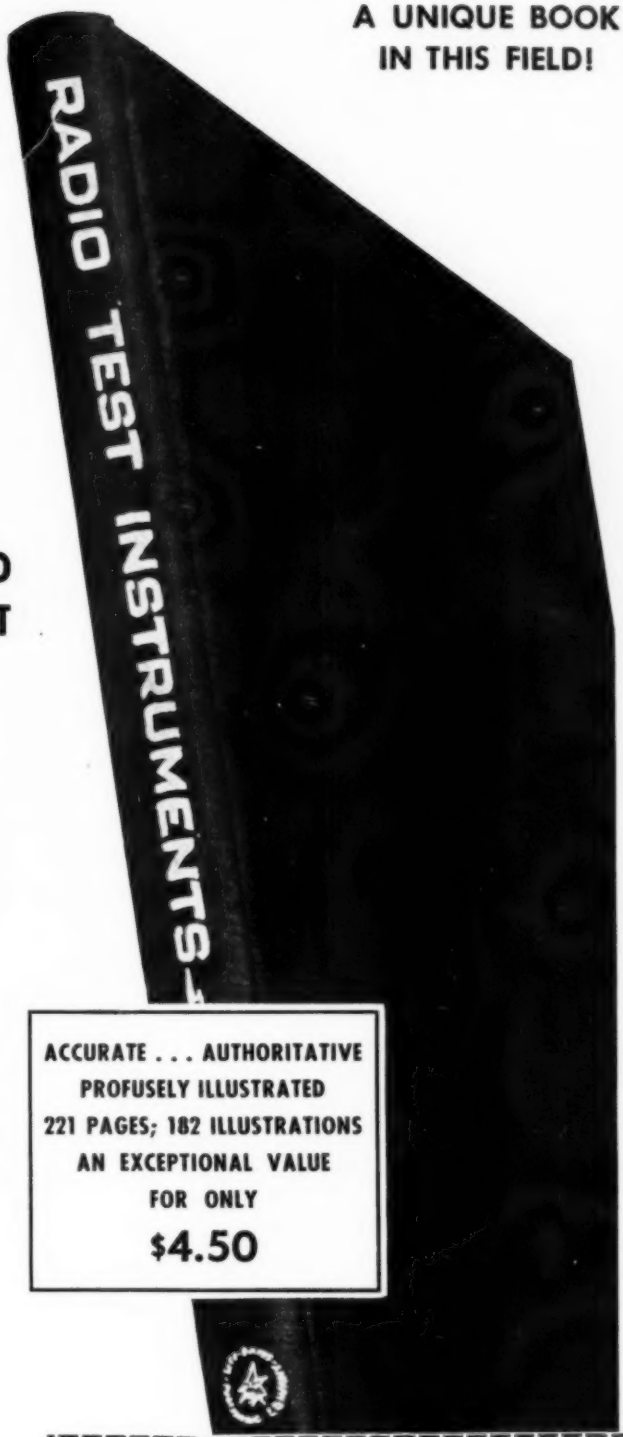

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ing and components which we wished to show in the photograph.

There is ample "breathing space" above and below the chassis, as will be seen from the photographs. This is essential to stable operation without feedback and interaction. The reader should avoid crowded construction as much as possible. The 807's, usually cantankerous as regards parasitics and feedback, were tamed completely by the baffle shield, tube shields, choke RFC_4, and parasitic suppressor resistor R_3. Since providing each of these features, the tubes have shown no inclination to take off on their own.

Wiring of the circuit is entirely conventional. Keep all filament leads tightly twisted and close to the chassis. Hold these leads down to the chassis with soldering lugs bent to act as clamps. Keep all r.f. wiring as close as possible to associated coils and tubes. Use *solid*, insulated hookup wire to insure rigidity of leads. Make every connection tight mechanically before soldering.

We believe that best results will be obtained through the use of separate power supplies, as indicated by the labelled input terminals in Fig. 2. This would call for separate d.c. units as follows: (A) 350 v. at 125 ma., (B) 250 v. at 100 ma., (C) 90 to 150 v., (D) 45 to 67½ v., and (E) 400 to 750 v. at 200 ma. Batteries may be used for (C) and (D), and, considering their long life and simplicity, they seem to have the edge on a.c. operated grid bias supply units. A single power supply can be used satisfactorily for (A) and (B), provided such a unit will deliver about 250 milliamperes with good regulation and provided also that it supplies the 250 volts separately for the 6B4-G stage.

Initial Adjustment

After the tube heaters are placed into operation, connect the external exciter to jack J_1. Place the 80-meter coils in positions L_1-L_2 and L_3. Feed in the external 80-meter signal and adjust C_1 to resonance as indicated by maximum brilliance of a pickup flashlamp coupled loosely to coil L_2. Now, neutralize the 6L6 stage, using either the pickup lamp or a crystal diode and milliammeter coupled to coil L_3, adjusting C_8 until no lamp or pickup meter indication is obtained as condenser C_4 is tuned throughout its range.

(1) Connect a 0-150 d.c. milliammeter to jack J_6.

(2) Connect a short piece of coaxial cable to jack J_3 and terminate this cable with a 50 to 72-ohm, 100-watt, noninductive resistor or a 100-watt *Mazda* lamp. No plate voltage should be applied to any part of the transmitter at this time. Do not connect "B+" to the 6L6 stage until neutralizing has been completed.

(3) Ground jack J_4 temporarily.

(4) Plug in the 80-meter tank coil, L_4-L_5.

(5) Connect the other power supplies, making sure that the C batteries are connected properly before switching on the plate and screen voltages to the 807's.

(6) Set condensers C_6 and C_9 to maximum capacitance.

(7) Switch on the external exciter (80-meter signal) and tune C_{12} for dip of the milliammeter. Examine the 807 circuits for parasitics.

(8) Transfer milliammeter to jack J_5, noting lower plate current reading. Retune C_{12} for plate current dip. If any retuning is required, the position of the center tap must be changed on coil L_4 until dip occurs at the same setting of condenser C_{12}, whether the milliammeter is plugged into jack J_4 or J_6.

(9) Repeat these operations on 20 and 10 meters. For 20-meter operation, feed a 40-meter signal into jack J_1. Plug in the 40-meter r.f. driver coil at L_2 and the 20-meter coil at L_3. (The r.f. stage does not need neutralization except on 80 meters.) For 10-meter operation, feed a 20-meter signal into jack J_1, plug in the 20-meter r.f. driver coil at L_2 and the 10-meter coil at L_3. Tune the 6L6 stage with the aid of a d.c. milliammeter plugged into jack J_2. Adjust the center tap on L_4, if required, according to instructions given in step (8).

(10) Remove ground jumper from jack J_4 and connect speech amplifier to J_4. Connect r.f. ammeter (0-2 amperes) in series with the load resistor connected to jack J_3.

(11) Note r.f. ammeter reading. Apply a continuous sine wave signal to the speech amplifier—or whistle a sustained single tone into the microphone. Note increase in ammeter reading on modulation. For 100 per-cent modulation, this increase will be 22½ per-cent of the initial reading. If a satisfactory increase is not obtained, it is very likely that the ratio of C_6 to C_9 is incorrect. Leaving C_6 at maximum capacitance setting, adjust C_9 until 100 per-cent modulation is obtained.

(11) Observe the output signal with an oscilloscope. This may be done by picking up a small amount of signal by means of a 2 or 3-turn coil of insulated hookup wire (about 2 inches in diameter) placed near coil L_4, and applying it to the vertical plates of the 'scope directly. Set the internal sweep oscillator of the 'scope to about 1000 cycles. Set the sync control to its *internal* position. A broad band will be seen on the screen. Make a note of the height of this band. Whistle a steady note into the microphone, or apply a sine wave signal to the speech amplifier and note that the band pattern changes to a string of solid cycles. Measure the height of this new pattern from the peak of a positive half-cycle to the peak of a negative half-cycle. At 100 per-cent modulation, the peak-to-peak distance will be twice the original height of the band pattern. For best operation, it may be necessary to adjust the bias voltages of the 807's between the limits shown at the

terminals in Fig. 2. It seems reasonable, however, that best operation will be secured when the higher voltage values are used. An added advantage also will be some form of r.f. output control in the external exciter.

(12) Listen to the modulated signal with a crystal diode monitor or well-shielded non-oscillating receiver, to check audio quality, speech cleanliness, etc.

Performance

Any voltage between 400 and 750 normally may be applied to the 807 plates. The r.f. output will be close to the table c.w. values of 25 watts for 400 volts, 30 watts for 500 volts, 40 watts for 600 volts, and 50 watts for 750 volts. At 750 volts, it may be advisable to employ a wider plate spacing in tuning condenser C_{12} than is specified in Fig. 2.

With the milliammeter in jack J_6, full 100 ma. should be read under loaded conditions with no modulation. The no-modulation plate current reading with the milliammeter at J_5 will be from 8 to 10 ma. Under full-loaded conditions *with* modulation, the plate current at J_6 will drop to approximately 65 ma., and the plate current at J_5 will rise to 35 ma.

In keeping with the features of the Taylor modulation system, the signal from this 807 rig will be found to have surprisingly narrow bandwidth and a loudness far exceeding expectations from either a 25, 30, 40, or 50-watt signal.

The author takes this opportunity to express his appreciation to Mr. R. E. Taylor of Los Angeles, originator and patent owner of the super-modulation circuit, for invaluable cooperation and guidance while the transmitter described here was under construction.

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TV CLINICAL MEETINGS SCHEDULED

DURING the next six weeks, radio-television service dealers, repairmen, and engineers in eleven metropolitan areas from coast to coast will attend the remainder of a series of clinical meetings conducted by Henry M. Joseph, chief engineer of the Coastwise Electronics Co. in Los Angeles, manufacturers of Ferret equipment.

Technicians, dealers, and engineers attending these meetings will be instructed in the newest methods and procedures of servicing modern TV equipment. All phases of alignment, repair, and servicing are discussed and demonstrated.

The latter half of the twelve-week series is scheduled for the following cities: Buffalo, May 31; Syracuse, June 1; Albany, June 2; Boston, June 3; New York, June 7, 8, 9, 10, 13; Philadelphia, June 20, 22; Baltimore, June 24; Washington, June 27; Atlanta, June 30; New Orleans, July 5; and Dallas, July 7. Among the cities covered during the first half of the schedule in April and May were Chicago, Pittsburgh, Cleveland, and Cincinnati.

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Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

CONDENSED DEALER CATALOGUE

Designed to provide greater convenience for radio and appliance dealers and television installers, and to industrial purchasers of electronic materials, a condensed dealers' catalogue has been issued by the *American Phenolic Corporation.*

The new listing illustrates *Amphenol* radio frequency cable and r.f. connectors, the most popular sizes and dimensions of polystyrene sheets, rods and tubes, and microphone connectors used in audio applications, measuring instruments, photoelectric devices, etc.

Also contained in the catalogue are descriptions of *Amphenol* TV and FM antennas and accessories, such as extension masts, stand-off insulators, insulator clamps, and mounting bases.

Refer to the Dealers' Condensed Catalog on business letterhead, addressing *American Phenolic Corporation,* 1830 S. 54th Ave., Chicago 50, Ill.

REPLACEMENT LOUDSPEAKERS

The first complete listing of all *Cletron* speaker types and sizes has just been issued by *Cleveland Electronics, Inc.,* 6611 Euclid Avenue, Cleveland 3, Ohio.

The catalogue includes radio speakers for use in the home and the automobile, FM and TV sets, and for sound work in laboratories and in public address systems. All of the *Cletron* speakers feature aluminum voice-coils and are built to RMA standards.

Copies of the catalogue may be obtained by radio service technicians and jobbers on request.

CLAROSTAT'S NEW NO. 49

Presenting an exceptionally complete line of resistors, controls, and resistance devices, a new No. 49 catalogue is available from *Clarostat Mfg. Co., Inc.,* Dover, N. H.

All of the items recently added to the *Clarostat* line are included, as well as additional numbers in the various listings. For greater convenience in radio service work, the listings concentrate on universal numbers wherever feasible, so that a minimum inventory will take care of maximum replacement needs.

RADIO SHACK LISTING

A 1949 catalogue of all the electronics equipment, covering the fields of communications, television, sound, testing, and research, that is distributed by the *Radio Shack Corporation* has recently been published.

The all-inclusive listing covers everything from completed equipment and kits down to the smallest components, as well as hardware, accessories, and literature. Another feature is a detailed index, showing the products by manufacturer.

Write the *Radio Shack Corporation* at 167-N Washington Street, Boston 10, Mass.

CATHODE-RAY TUBE BOOK

The booklet describing the modern cathode-ray tube, published by *Allen B. Du Mont Laboratories, Inc.,* has come out in a new edition of 63 pages.

This edition includes material relative to the history, development, design and structure, and the uses of the cathode-ray tube. In addition to the full-page frontispiece reproduction of a wall chart depicting the modern cathode-ray tube, there are 68 illustrations provided to add to the general interest and attractiveness. Besides the information on the cathode-ray tube, as such, there are chapters on the cathode-ray oscillograph, television, and radar.

The booklet, "The Cathode-ray Tube and Typical Applications," is available generally to the trade through radio-parts jobbers for the sum of fifty cents.

RCA KINESCOPE COMPONENTS

The Tube Department of *Radio Corporation of America* is offering a 32-page booklet, "*RCA* Television Components for Kinescope *RCA*-16AP4," which provides technical data on characteristics and dimensional outlines for components used in designs employing the *RCA*-16AP4 picture tube.

The booklet, in addition, contains typical deflection circuits and an associated circuit of a pulse-operated, high-voltage supply for the 16AP4.

When writing ask for Form CTV-1004, addressing Commercial Engineering, *RCA* Tube Department, Harrison, N. J.

DYNAMOTOR CATALOG NO. 649

A companion piece to its No. 349 Converter Catalog is being offered by the *Carter Motor Company,* 2644 N. Maplewood Avenue, Chicago, Ill. This is the No. 649, consisting of 24 illustrated pages.

The booklet gives complete mechanical and electrical specifications on all *Carter* dynamotors, including the original genemotor and magmotor. Performance charts, oscillograph reproductions, and dimensional diagrams supplement the hundreds of specifications covering the various standard models.

Requests for this comprehensive literature should be made on company letterhead addressed to the manufacturer.

INDIVIDUALIZED TV INSTALLATIONS

The custom-made television units manufactured by *Sightmaster Corporation* are described in a recently published booklet, which gives diagrams and specifications for the installations.

These units are installed in a wall, and the television picture is seen in a decorative frame on the wall. A feature exclusive with *Sightmaster*, called "Sightmirror," transforms the television viewing area into a mirror when video is not being received, making it ideal for luxurious living rooms, but it is also suitable for classrooms, offices, or reception rooms.

The booklet may be obtained from the New York office of *Sightmaster Corporation*, at 20 East 35th Street, Zone 16.

CUSTOMER RELATIONS HELPS

A manual of public relations, prepared in handy, pocket-size form, fully illustrated for easy reading, is being offered by the *Radio Corporation of America*.

The booklet contains helpful hints on how to win and hold customer goodwill, ranging from such details as how the service technician should properly introduce and identify himself on his first contact with the customer, to ascertaining customer preference in placement of the receiver and antenna.

Entitled "The Care of Television Customers," this handbook, originally compiled for use by *RCA* TV service technicians, is being made available to the radio and television trade. Single copies may be obtained from the *RCA* Service Company, *RCA Victor Division*, Camden, New Jersey.

STANCOR REPLACEMENT CATALOGUE

A four-page illustrated catalogue on the *Stancor* line of television replacement components, including two horizontal output transformers recently introduced, is now available from *Standard Transformer Corporation*, 3580 Elston Avenue, Chicago 18, Ill.

The two new units, A-8117 and A-8118, are designed for replacement of the parts used in leading brands of TV receivers. Other *Stancor* TV components, such as deflection yokes, focus coils, and filters chokes, are described with detailed specifications and prices. Ask for Bulletin DD337R.

LATEST HICKOK MODELS

A new four-page folder describing and illustrating the complete line of dynamic mutual conductance tube testers is offered by the *Hickok Electrical Instrument Company*, 10524 Dupont Avenue, Cleveland 8, Ohio.

The folder is attractive and shows complete specifications of counter, portable, and display models, with technical and exclusive features itemized.

TWO NEW VICKERS PUBLICATIONS

Two catalogues are being offered by the *Vickers* Electric Division, *Vickers, Inc.*, 1815 Locust Street, St. Louis 3, Missouri: the Selenium Rectifier Catalogue—VC-3000, and Photoelectric Cell Catalogue—VC-4000.

The first, VC-3000, is a 24-page booklet illustrating rectifier characteristics, applications, design factors, and list prices. The other, a 12-page affair, illustrates self-generating photoelectric cell applications and design specifications.

Both are supplied with graphs and illustrations and contain much information that should be helpful.

ELECTRONIC GUIDE

The Potter Instrument Company, Inc., 136-56 Roosevelt Avenue, Flushing, New York, is offering a brief guide to its line of high speed electronic counters, scalers, counter chronographs and special electronic frequency measuring and computing equipment in a four-page condensed catalogue.

A discussion of the electronic counting principle, methods of count detection, and typical applications is included in this booklet in addition to

the description of the available standard counters, and "special problem" equipment for use in special-application calculating and timing.

EXPANDED CONDENSER CATALOGUE

The new *Illinois Condenser* catalogue recently announced contains detailed information on an expanded line of condensers, developed to serve the entire electronic field, from radio to television. The items shown supersede all prior listings.

Address *The Illinois Condenser Company,* 1616 N. Throop Street, Chicago 22, Illinois.

MOT-O-TROL BOOKLET

Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, Pa., has issued a 23-page booklet on Mot-O-Trol, its packaged electronic, adjustable speed drive for precise control of d.c. motors operated from a.c. sources.

Divided into three sections, the booklet discusses what Mot-O-Trol is, its construction and maintenance, and its technical applications, including typical uses in many industries. In writing, specify booklet B-4112.

-30-

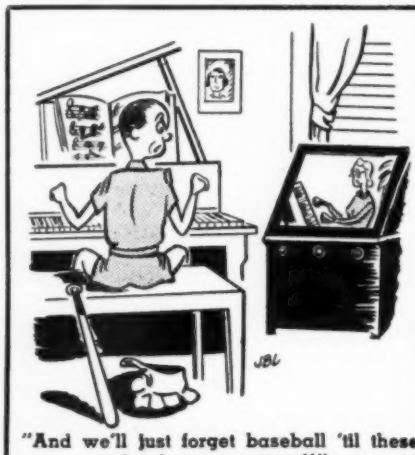
S.R.R.C. OUTING AT CAMP KI-SHAU-WAU

ENTERTAINMENT, fun, and exhibits will be the order of the day at the Starved Rock Radio Club hamfest June 5. The location will be the Boy Scout Camp Ki-Shau-Wau, near Starved Rock State Park, Illinois.

An important part of the program will be the distribution of door prizes to registrants holding numbers drawn from tickets given each person attending. Recognition will be given to all those contributing equipment or credit slips for door prizes by the publication of donors' names and addresses in the club's advertising.

The S.R.R.C., using call letters W9MKS, was organized in 1934, and is proud of the reputation of its sponsorship of radio ham meetings. Members believe about 500 or more hams will attend. To obtain advance registration, at $1.00 ($1.50 at the gate), call on S. N. Warrner, W9TLC, President, S.R.R.C., Box 22A, Utica, Illinois. Lunch will be provided on the grounds, and there will be plenty of shelter, rain or shine.

-30-



"And we'll just forget baseball 'til these chords are mastered!"

International Short-Wave
(Continued from page 40)

cotton, palm-nuts, coffee, cocoa, rubber, copal gum, sugar, and ivory. Mineral products consist of copper, diamonds, gold, tin, cobalt, tantalum, silver, and radium. The Belgian Congo ranks high among copper-producing countries. The diamond fields in the southwestern district produce more than 6,000,000 carats a year, mainly industrial diamonds, of which the Congo is the world's largest producer. The uranium ore from the Katanga district is high-grade and furnishes about 90 per-cent of the world's supply of radium. The Katanga copper belt is 250 miles long by 25 to 50 miles wide.

To *"The International Goodwill Station,"* OTC, its staff, and its OTC Club go our best wishes for the future.

* * *

Radio Indonesia

At the time this was compiled, John J. Gaynor, California, had just received, via airmail, word from Charles Stuart, producer and program director of English Foreign Broadcasts Section, *Radio Indonesia,* Batavia, that the "100 kw. transmitter is almost ready for testing." *Watch for this one which by now may be on the air!*

Mr. Stuart sent along this current list of transmitters of *Radio Indonesia* (ones without call signs are Armed Forces Program Broadcasters):

By frequencies: 2.240, YDB, 300 watts—*Batavia, Java;* 2.350, YCN, 250 watts—*Pontianak, Dutch Borneo;* 2.415, YDA2, 150 watts—*Bandoeng, Java;* 2.500, YDH, 100 watts—*Semarang, Java;* 2.600, YDD, 300 watts—*Batavia, Java;* 2.820, 300 watts—*Garoet, Java;* 3.240, YDI, 300 watts—*Surabaya, Java;* 3.270, YDL, 350 watts—*Padang, Sumatra;* 3.332, 800 watts—*Solo, Java;* 3.380, YDR, 250 watts—*Ambon, Moluccas;* 3.390, YDA, 3 kw.—*Bandoeng, Java;* 4.370, YH12, 5 kw. *Surabaya, Java;* 4.840, YD14, 1.2 kw.—*Surabaya, Java;* 4.855, YDK, 250 watts—*Palembang, Sumatra;* 4.965, YDD, 300 watts—*Batavia, Java;* 4.895, 40 watts—*Biak, Dutch New Guinea;* 4.910, YDB2, 300 watts—*Batavia, Java;* 4.930, YDP, 250 watts—*Medan, Sumatra;* 5.030, YDQ, 250 watts—*Makassar, Celebes;* 5.070, 800 watts—*Jogjakarta, Java;* 5.515, YDH2, 800 watts—*Semarang, Java;* 5.620, 800 watts—*Jogjakarta, Java;* 6.170, YDB3, 1 kw—*Batavia, Java;* 7.210, YDF2, 350 watts—*Medan, Sumatra;* 7.270, YDB3, 300 watts—*Batavia, Java;* 7.295, YDI3, 500 watts—*Surabaya, Java;* 9.550, YDQ2, 8 kw.—*Makassar, Celebes;* 9.720, 400 watts—*Menado, Celebes;* 10.365, PLB4, 3 kw.—*Batavia;* 10.640, 500 watts—*Fort de Kock, Sumatra;* 11.000, PLB9, 250 watts—*Batavia, Java;* 11.084, YDQ3, 2.5 kw—*Makassar, Celebes;* 11.770, YDE, 3 kw.—*Batavia, Java;* 15.150, YDC, 3 kw.—*Ba-*

tavia, Java; 17.630, 2.5 kw.—*Batavia, Java,* and 19.345, PLF2, 2.5 kw.—*Batavia, Java.*

* * *

SBC

Here is some interesting information furnished by Starry, Pa., concerning the Swiss Broadcasting Corporation:

The chief of technical service writes Starry—"The Swiss Broadcasting Corporation maintains seven studios—in Basel, Berne, Zurich, Geneva, Lausanne, Lugano, and those of the short-wave service, also in Berne. All radio transmitters are being operated by the Federal Administration of Post, Telegraph and Telephone, exclusively. The center of Swiss short-wave transmitters is Schwarzenburg, a prosperous village in the Canton of Berne. They are used both for overseas telephone service and for broadcasting. Schwarzenburg has eight short-wave transmitters, with powers ranging from 10 to 100 kw. For overseas service, rhombic antennas are being used, and for the European Service, circular dipoles are employed. Schwarzenburg is located some twenty miles south of Berne, capital of Switzerland, and works together with the receiving stations of Chatonnaye, in the Canton of Fribourg. The transmitting station at Schwarzenburg was constructed by *Hasler & Co.* of Berne, licensed by *Marconi Wireless Telegraph Co., Ltd.,* at Chelmsford, England."

Another official informed Worris, N. Y. that "the power of two of our transmitters is 25 kw. and we now have three at 100 kw. The bearings are on—for the various transmissions —New York, Winnipeg, Buenos Aires, Lima, Cape Town, Sydney, Melbourne, Tokyo, and Palestine."

* * *

Pakistan Verified

Via airmail from Government of Pakistan, Office of the Engineer-in-Charge, High Power Transmitters, *Radio Pakistan,* Headquarters, Karachi, Pakistan, on April 9, I received this message:

"In reply to your letter dated February 15 (forwarding the reception report of *Radio Pakistan),* I am sending you herewith a copy of our current Programme Journal *(Pakistan Calling)* and our verification card. Our present short-wave transmitter at Dacca is a 7.5 kw. set beamed towards the West by means of a single rhombic. We hope to operate two more 50 kw. short-wave transmitters from Karachi after a few months, and we shall be glad to get reception reports from you and from all such listeners from whom you might find possible to secure these for us." The signer was I. A. Ansari, Deputy Engineer-in-Charge.

The verification card is white with a green-and-black design (evidently the official insignia of Pakistan) in center; at the bottom in modern printing is the wording: "We have great pleasure in confirming your reception report of *Radio Pakistan,"* followed by a list of places where *Radio Pakistan* is now located—Karachi, Peshawar, Lahore, and Dacca (only Dacca was on short-wave when verification was made). Dacca was checked on the card, confirming my reports for February 13 and 15.

The *Pakistan Calling* was Vol. 2, No. 6 for March 16; it is issued fortnightly. Schedule for Dacca, 15.270 (this one now in use although *Pakistan Calling* listed both 15.27 and 11.89) was given: *Transmission I*—2030-2200; *Transmission II*—0030-0130; *Transmission III*—0600-1130; news in *English* at 2130, 0120, 0730, 1030.

* * *

Verification Data

Former KZRH and KZMB (now DZH-2 and DZH-4, respectively) do verify according to a letter sent to NZDXRA's bulletin *"Tune In";* they say—"Both KZRH and KZMB do send out QSL cards. . . . We have had in the past few months a number of DX reports from N. Z., and as far as I have checked, these have been verified . . . but please assure your fellow DX-ers that we shall be glad to verify any reception reports received by us." Letter signed by general manager W. H. Wallace. (Gillett, Australia)

A letter from *Radio-Lebanon,* Beirut, Lebanon, recently came from Press Officer, Information Department, British Legation, Beirut, Lebanon; said *English* programs from *Radio Lebanon* are under the direction of "the information office of this legation," and asked for reports from time to time. (Pearce, England)

Radio Clube de Mocambique, "The Station for Happy Listening," sends new type of QSL card for CR7BU, power 7.5 kw., frequency 4.920 (but is nearer 4.930); other channels listed were 9.65, 4.82, 3.49, and 9.72. (Pearce, England) *(Note that more recently the 9.72 outlet has been heard on approximately 9.76, instead.—KRB)*

Reports to stations of ABC in the Inland Short-Wave Service should be sent to the Australian Broadcasting Commission in the capital city where transmitters are located (currently used ones include VLG6, VLR, VLH4, VLH5, VLH3, VLI2, VLI3, VLQ3, VLW3, VLW5, VLT5, VLT7).

QRA for Addis Ababa station is Imperial Ethiopian Government, Press and Information Department, Addis Ababa, Ethiopia. (Nattugglan, Sweden)

Address for CR6RG is Companhia de Diamantes de Angola, CR6RG, *Radio Diamang,* Dundo, Angola. (Nattugglan, Sweden)

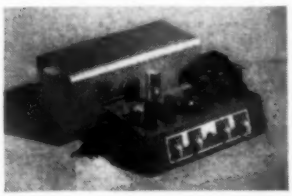
Latest QRA for Tokyo s.w. stations seems to be R. H. Niino, Liaison Section, Nippon Hose Kyokai, Radio Tokyo Bldg., Tokyo Central Post Office Area, Tokyo, Japan. (Hardy, Calif.)

QRA of YSUA, 6.250, is *"Radio Mil Cincuenta,"* la Avenida sur No. 50, San Salvador, Republica de El Salvador, C. A. (Hankins, Pa.)

IRC's are still not negotiable in French Indo-China, so do *not* send

OUTSTANDING VALUES NOW AVAILABLE

CLARK 15 WATT AMPLIFIER KIT



Another popular Clark kit. All first line parts to make an exceptionally fine unit.

• 6 tubes—2—6SQ7, 2—6V6, 1—6SN7, 1—5Y3GT. • Mike and phono input. • Separate treble and bass controls. • Heavy steel chassis and cover. • Frequency response 30-17000 CPS + 1DB. • Output impedances 4-8-16-500. • Hum level 65 DB below rated output.

Kit comes complete with all tubes and parts—ready for installation. Schematic, layout and instructions.

ONLY **$18.95** each

SNYDER AUTO ANTENNAS

Exceptional values—top quality.

Side Cowl—2 point mounting—fine chrome finish—66" extended—sturdy construction—with shielded lead. **$1.79** each

Top Cowl—Universal mounting joint—sturdy construction—chrome finish—60" extended—with shielded lead. **$1.99** each

ICA 100" Side Cowl antenna. High chrome finish. Shielded lead. Firm construction. **$1.99** each

Five to a carton..... **$9.50**

Heavy magnet 6" PM Oxford. Suitable for auto radio replacement speaker. 2.15 oz. alnico V magnet. **$1.59** each

AUTOMATIC CAR RADIO

Fits any car. Easily installed. Will perform as well as the finest auto radios. Powerful 6 tube superhet. 3 gang tuning condenser for extra sensitivity. Full vision, slide rule dial. Beautifully finished case with decorative plastic tuning assembly. List $39.95.

Your cost **$27.97**

SUPER 25 WATT HI-FI AMPLIFIER KIT

Including all parts, schematic and layout diagrams, enabling you to easily build this fine, deluxe amplifier.

FEATURES:

- **Ready punched chassis**
- **Multi-impedance output transformer 2-4-8-16-500 ohms for use with any PM speaker**
- **2 mike inputs, 1 phono input**
- **Push pull phase inverter driver for low hum and distortion**
- **Hum level 65 DB below rated output.**
- **Separate bass and treble control**
- **110-120 volt AC operation, on fuse UL approved line cord**
- **6 tubes: 2—6SJ7, 6SC7, 2—6L6G, 5Y3**
- **Attractive, well-constructed steel chassis and cover. Baked hammerloid finish**
- **Indirect lighted panel**
- **Frequency Response 20-17000**

Nowhere can an amplifier of comparable features be had for twice the price. This amplifier, designed from the famous Clark Amplifier, will fill 90% of all sound uses.

$24.95 COMPLETE WITH TUBES

CROWE HEADS for AUTOMOBILE RADIOS

1940 thru 1949

Under 1940 — Universal Underdash Mounting Dials. Dealers' Price..... **$4.41**

Tuning Units 706-T1 up thru 720-T1. Dealers' Price..... **2.03**

Tuning Units with switch 706-T2 up thru 720-T2. Dealers' Price..... **2.80**

Volume control units 700-V1. Dealers' Price..... **.88**

Volume control units with switch 700-V2. Dealers' Price..... **2.12**

Cable kits to fit Delco-Arvin-Philco. Dealers' Price..... **2.09**

Motorola Cables. Dealers' Price..... **2.80**

When ordering, specify Make and Model of car and make and model of radio. Complete dial kit consists of "Head, Tuning Unit, and Volume Control Unit."

We carry a complete line of all auto radio equipment and accessories.

AUTOMATIC TOM THUMB "BUDDY" PORTABLE RADIO

Self-charging portable radio with patented battery rejuvenator. Increases normal battery life. Operates on AC, DC or battery. Very attractive case. 7 tube performance. Slide rule tuning dial. Batteries 67½ VB—2-1½ A.

$29.95 Complete with batteries.

PREMIER VALUES

Standard replacement 4-prong vibrators. New—guaranteed. **$1.39** each

10 for $12.50

Philco filter condensers. 40 x 10 mfd-200 V. **32c** each

10 for $2.90

Standard replacement type phono. cartridge. Hi-gain—standard mounting. **$1.39** each

10 for $12.90

RMA guarantee 10 BP4CR tubes..... **$25.00** In factory sealed cartons.

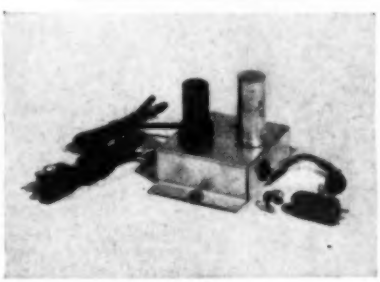
6" 6 volt 4 ohm Motorola-type auto speakers. **$1.59** each

10 for **$14.90**

300 ohm transmission line. Heavy polyethyline insulation. 1000 ft. spools.

$14.00 per 1000, Lots of 3000, $38.95

RELUCTANCE CARTRIDGE



Well-known reluctance type phono cartridge. For best phono reproduction. With Farnsworth pre-amp. Will replace G-E reluctance cartridge and pre-amp. These two fine units for only..... **$7.29**

Individually..... Reluctance cartridge. **$3.40**

Farnsworth pre-amp. **$4.50**

WRITE FOR OUR LATEST CATALOG

Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.

them to *Radio Saigon*. QRA is Jean Pipon, English Department, *Radio Saigon*, Boite Postale 412, Saigon, French Indo-China. (URDXC)

Address for papeete is *Radio Club Oceanien*, Papeete, Tahiti. (DeMyer, Mich.)

• • •

Club Notes

England—ISWC, London, is now conducting an anniversary series of contests extending to July 31. Competitors are urged to (1) log as many amateur s.w. stations as possible and (2) to log as many international SWBC stations broadcasting the special *ISWC* programs as possible (these include *Radio Australia*, many stations in Europe, some in Africa, and in North and South America, and in October in all BBC overseas transmissions from London). Prizes include a silver trophy for the winner, several useful pieces of radio apparatus, also radio handbooks, and special radio manuals provided by leading radio dealers and manufacturers as well as by publishers interested in radio. Full details of the club's activities are available from Arthur Bear, 100, Adams Garden Estate, London, S. E. 16, England. (Rigby, ISWC, England)

Bachman, Pa., sends this data—"You may be interested in news of a new British club known as *The Listeners' Association*. Membership is open *only* to residents of the United Kingdom and to British citizens abroad. However, they will accept donations for their cause from anyone. Full information may be obtained from the secretary, Capt. C. H. Rolleston, 71, Victoria Road, Kensington, London W. 8, England. *The Listeners' Association* is a non-commercial body. It exists as a national organization to further the interests of the listener by acting as an intermediary between the listener and the BBC."

Sweden—Lars-Eric Hansson, Sweden, sends along this information—Goteborgs DX-Klubb (The Gothenburg DX Club) was founded in January 1947 by Anders Sandberg. At the beginning it had only five members. During the first year, the club grew very slowly, but then it began to expand more rapidly and now has about 50 members. Most of these are from Gothenburg, but there also are some members in other parts of Sweden, plus a British member and a German member. Mr. Sandberg is chairman; vice-chairman is Alf Hellstrom; secretary is Bertil Thorner; treasurer is Jean Hultbergh; other staff members include Helge Rydberg and Mr. Hansson; deputy of the staff is Nils Hildebrand. The members in Gothenburg get together each second Thursday at a cafe, where they spend a few hours discussing their hobby. The members also get an opportunity to read the short-wave magazines which the club gets on an exchange basis. The club's house organ, issued monthly, is called *GDX-aren* (The GDX-er) and was first

issued in December, 1947. Editor is Mr. Thorner; DX items are compiled by Mr. Hansson. Membership fee currently is four Swedish crowns and the QRA is Goteborgs DX-Klubb, % Bertil Thorner, Ockerogatan 3a, Goteborg W., Sweden.

USA—QRA of *The Dial Spinners' Club* is 75 Langdon Place, Lynbrook, New York; president is Bill Frothingham; vice-president is Tom Orr, 907 Fulton St., Rapid City, South Dakota. (Cornell, Ala.)

A new feature of the Short-Wave Listeners' Registry is the printing of a 1949 radio and hobby directory which will list all radio fans and hobbyists who have sent QRA's to the club. Purpose is to spread SWL friendship throughout the entire world, says Bill Camp, Club Editor, Short Wave Listeners Registry, 1042 Water St., Moosic 7, Pa.

* * *

This Month's Schedules

(NOTE: Between the time this was compiled and the time you read it, some stations will have gone on Summer Time—in such cases you will find current schedules to be *one hour earlier than listed herein.*—KRB)

Aden—ZNR, 6.765, heard well in England around 1415. *(ISWC) Can anyone confirm this report?—KRB*

Algiers—Radio Algiers, in verie, states "We broadcast very day from 1300 to 1500 in Arabic and from 1500 to 1800 in French"; frequency 9.570. (Gillett, Australia) Reported testing on 11.835 at 0500-0700. *(Radio Australia)*

Andorra — Radio Andorra, 5.978, heard recently from tuning 1745 to leaving it 1845, usual program of recordings and announcements. (Ferguson, N. C.)

Angola—via a verie card, *Radio Clube de Angola* advises that CR6RL, 9.470, and CR6RN, 8.090, operate 1330-1600, while CR6RA, 10.795, is on the air 0100-0300. (Gillett, Australia) CR6RH, 8.232, Hilla, has extended its schedule by a half-hour, now runs to 1500. (Swedish DX) *Radio Diamang,* CR6RG, 8.242, Dundo, heard 1400 to sign-off 1430 with Portuguese National Anthem; speech intelligibility low, with bad QRM from stations using both c.w. and (commercial) phone; another day heard from 1345 with orchestra music; has both man and woman announcer; *no English noted.* (Pearce, England)

Radio Clube de Angola, Luanda, sent QSL card for reception of CR6RN, 7.142; said this replaced the 8.090 channel, and asked for a check on CR6RL on 31.68 meters (approximately 9.470). (Pearce, England)

Argentina—LR4, *Radio Splendid,* Buenos Aires, appears to be on 11.880. (Stark, Texas) Bachman, Pa., lists this as LRS-2 and says *is* on 11.880, evidenced both by dial setting and by Spanish and *English* announcements; excellent 1815-1915. Leven, Brazil, also believes LRS-2 has moved from

11.84 to 11.88, comments that formerly on 11.88 was LRR, *Radio Ovidio Lagos*, Rosario, which has not been heard for some time.

Buenos Aires, 15.290, noted a little before 1600, relaying LR1, *Radio El Mundo* and giving s.w. calls of LRX and LRX1; going at least to 1700 (now on winter time?). (Stark, Texas) Heard in New Zealand (an earlier report) to sign-off 1605. (N. Z. *DX Times*)

LRA1, 9.69, Buenos Aires, heard in Newfoundland 2030-2200 sign-off. (Peddle)

LRY1, 9.455, Buenos Aires, heard testing around 2320 to sign-off 0000; announced in Spanish and *English*, said testing to Europe; good signal in North Carolina; LRA1, 9.690, heard with announcement in Spanish of *"Radio del Estado,"* and at 1830 announced official time as 2030, good signal. The 15.29 outlet heard with test transmission for Central and Western Europe from tuning 2128 to sign-off 2158; announcements were in Spanish and *English*, good level. (Ferguson)

Australia—VLR, 9.54, Melbourne, heard in England from around 0230 to closedown 0330. (Pearce)

AUSTRIA — *Sendergruppe West*, Dornbirn, good on 6.000, opening 0000 weekdays and 0100 Sundays. (N. Z. *DX Times*)

KZCA, 7.220, Salzburg, apparently has ended Saturday tests (which ran *after* 1800); heard in clear around 0400 and from around 0900 to 1000, other times jammed; QRA when testing was given as Station KZCA, A.P.O. No. 541, U.S. Army. (Pearce, England)

Azores—CS9MB, 11.090, Ponta Delgada, still 1500-1600, fair level, heard signing off 1600. (Ferguson, N. C.)

Bechuanaland — ZNB, 5.900, Mafeking, has been logged in England on a Sunday to 1430, weekdays to 1615, according to an item from a recent Swedish DX session.

Belgian Congo—OTH, 9.210, heard in Australia with native program and some announcements in French before signing off 1330 with anthem; reference made to *Radio Congo Belge;* good signal. (Gillett)

Leopoldville's OTC, 9.767, has announced it is now sending out report sheets to listeners. (Lyttle, Ontario)

Belgium—Brussels, 21.460, has been heard with tests, good strength, at 0600-0630, then going into scrambled speech. (N. Z. *DX Times.*) Is listed 21.450, where was heard recently by Arthur, West Virginia, calling Buenos Aires but could not make contact. *Radio Australia* reports the 21.450 channel testing 0400 with announcements in French and *English*.

Brazil—Ceara Radio Clube, 15.165, Fortaleza, heard to 1600; announced in Portuguese, Spanish, French, and *English;* believed to open 1500. (Stark, Texas.) Boice, Conn., got this letter from the station recently—"Your most welcome letter just reached us, and we surely were glad to hear from you. We would very much appreciate your telling your friends there in Connecticut about our International Programme for we don't receive many letters from the States, which we sincerely regret. So give us a hand, will you? Your cooperation will be greatly appreciated by us. Let us hear from you again, won't you?" The International Programme is on the air Mondays and Fridays 1300-1500 over ZYN7, 15.165, with announcements in Portuguese, *English*, Spanish, and French, Boice advises.

Lyttle, Ontario, says he has heard PSH, 10.220, Rio de Janeiro, with good signal on many occasions around 1730-1800.

Weisberg, N. Y., says ZYK3, 9.565, has *English* daily ending 2045.

ZYB9, 15.155, Sao Paulo, heard with Portuguese and *English* language musical selections on Tuesday nights 1930-2000; *no English announcements*, but these musical numbers might help in building up a report for a QSL if the listener doesn't understand Portuguese; strong signal in Pennsylvania. (Bachman)

Radio Nacional, 18.050, Rio de Janeiro, heard with recordings when tuned 2005; at 2007 announced *"Radio Nacional"* and continued with music and announcements in Portuguese; at 2020 called Buenos Aires, Lima, and New York but did not seem to make contact; good signal. (Ferguson, N.C.)

Levens, Brazil, writes—"*'Radio Tamoio'* is now on the air with two transmitters—ZYC8, 9.61, and ZYC9, 15.370; so far schedule is 0500-2200, transmission being parallel on both allocations.

(*Continued on page* 131)

PARTS MEN TAKE TO THE WOODS

OUTDOOR Minnesota will be the scene of the Gopher Upper Midwest Radio Conference late this summer sponsored by the Gopher Chapter of the Representatives of the Radio Parts Manufacturers. The combined three-day business conference and outing will be held at Ruttger's Bay Lake resort at Deerwood, about 100 miles north of Minneapolis. Executives from factories represented by the Gopher members will meet distributors' key personnel from Minnesota, the Dakotas, Wisconsin, Iowa, and Nebraska.

Business sessions will be combined with fishing, boating, golf, tennis, swimming, and what-have-you, from Wednesday afternoon, August 31, through Saturday noon, September 3. Reservations may continue over the Labor Day weekend for those who wish to extend this trip into an added vacation. All arrangements and reservations are being handled by the Gopher Chapter, and attendance is expected to run close to 300.

This invigorating and attractive background for a business conference is a welcome departure from smoke-filled convention rooms, and the well-planned schedules are expected to accomplish much in factory-distributor relations.

—30—

Screen Modulated Final

By J. D. KLINE, W6CXM

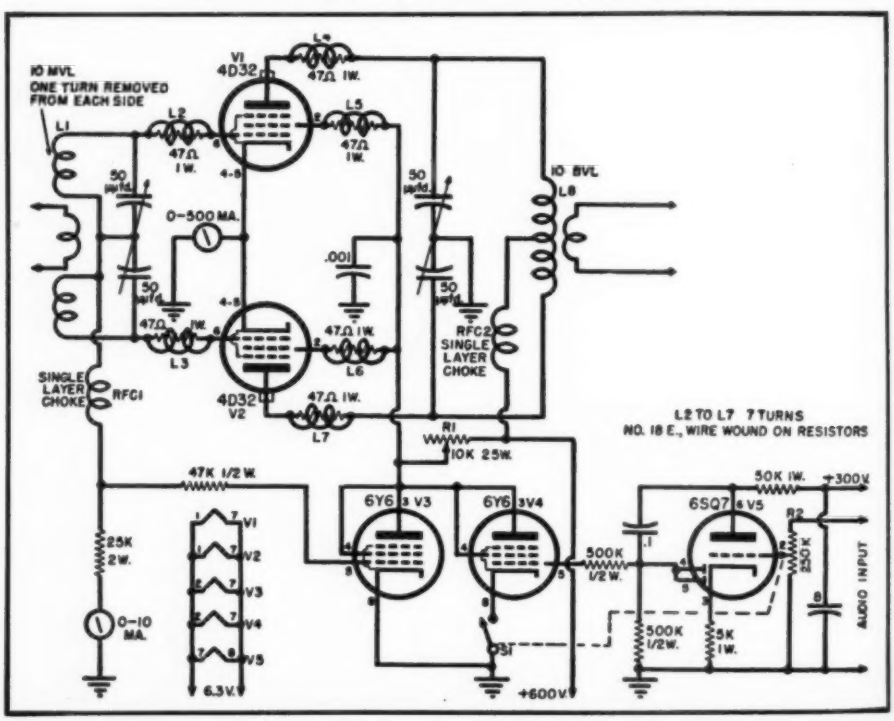
A unique transformerless modulation system that can be applied to any screen-grid tube.

THIS final has as its only claim to existence a unique modulation system that can be applied to any screen-grid tube. There are several advantages: It has no transformers and therefore no problem of impedance matching. It doesn't superimpose an audio voltage on an existing d.c. screen voltage, so the danger of overmodulation is minimized. The unmodulated portions of a transmission are, with the carrier, reduced, so a great saving of current is realized. The efficiency may not be as high as in some other systems, but almost everything in radio is a compromise, and this is no exception.

Two 4D32 tubes are used in push-pull with 600 volts on the plates. There are two 6Y6's tied to the screen. One of these controls the 4D32's when excitation is removed and prevents the plate current from being excessive by grounding the screen through the plate impedance of the 6Y6. The other 6Y6 receives its bias from rectified audio, supplied through a conventional amplifier and the 6SQ7. This 6SQ7 is similar to an ordinary a.v.c. circuit but has no time delay or RC circuit to affect the length of time that the carrier is on so will turn it on at each audio cycle to make it an audio-controlled carrier. When the bias is removed—at the end of a cycle, a breath, or pause—there is no bias on the second 6Y6 (V_4); it draws more current, the voltage drop across the screen resistor increases and drops the voltage at the screen, thereby removing the carrier instantaneously, or modulating it at an audio rate. Here at W6CXM, the plate current swings from about 50 ma. minimum to about 350 ma. maximum, with no apparent distortion.

The rig is very simple to adjust. The potentiometer, R_3, with S_3, is turned off, which will allow the plate current to rise, and the screen voltage then can be adjusted to the normal value for c.w. operation (4D32 has about 300 v.). Excitation must be applied at this time, or the first 6Y6 (V_3) will draw current and keep the plate current of the 4D32 down. After the screen voltage is adjusted, R_2 is turned up, closing S_1, and the plate current of the 4D32 will drop to a low value, rising with modulation. The same system could be applied to any tube where a screen dropping resistor is used, provided, of course, the screen resistor is large enough to operate with the 30 or 40 ma. drawn by the 6Y6. I have used types 6V6, 6L6, and 6Y6, and all seem to work, but the 6Y6 has the lowest plate resistance, and thereby cuts the carrier down lower. —30—

Schematic diagram of transformerless modulation unit.



Simple TV Tuner

(*Continued from page 49*)

Make sure the oscillator frequency is on the high side of the fundamental frequency. If it is, the image frequency will appear on the high side of the fundamental frequency. If the image appears on the low side, the oscillator coil will require fewer turns for that channel. All of these tests can be made by modulating the signal generator and listening to the audio output of the receiver.

The alignment of the mixer grid coils is as follows: Tune the signal generator to the highest channel frequency. Rotate the channel switch to number one position and adjust L_1 for maximum audio output. L_2 is a short and requires no adjustment at this time. Next adjust L_3 then L_4 and then L_5. All adjustments made at this stage are preliminary, but the oscillator coils will more likely than not require further adjustment.

It is possible to adjust L_1, L_6, and L_7 by spreading turns. The other coils are adjusted by removing turns. It is advisable to make several extra coils just in case too many turns are removed during adjustments.

Final adjustments are made while receiving a television signal. The oscillator coils can be adjusted so it is not necessary to adjust condenser C_6 for every station. Such adjustments will be critical. Condenser C_6 will give several megacycles change making the oscillator coils non critical.

The final adjustment of the mixer grid coils is made in favor of the picture. The coils should be adjusted to give maximum picture gain. This can be noted by the position of the contrast control.

The use of a small iron core simplifies this adjustment. Insert the core into the coil and note increase or decrease in gain. If the gain increases when the core is inserted in the coil, more inductance is required. On the other hand if the gain decreases, less inductance is required. By substituting a small hairpin of wire for the short circuit, L_2 can be adjusted. The adjustment of the coils is not difficult. If strong television signals are available, it is possible to adjust all coils on received signals.

The coils described are reasonably close to the desired frequencies. If the tuner is tuned within a few megacycles of a television signal, the buzz of the picture carrier can be heard. Rotate condenser C_6 for maximum buzz. Note the position of the condenser. If at full capacity, more inductance will be required in the oscillator coil. If at minimum capacity, less inductance is required. Make the necessary coil change and adjust condenser C_6 again for maximum buzz or actual television sound channel.

Of course, it is more desirable to make first adjustments with test equipment, but if such equipment is not

available the above method will work provided adequate signal strength is available in your locality.

If a picture is received but no sound, the oscillator will be tuned to the low frequency side of the fundamental frequency.

Short leads are necessary if Channel 13 is to be covered. The total length of wire in this oscillator coil is approximately one and a half inches. Unnecessary lead length in wiring can increase the circuit inductance to a point where this frequency cannot be covered.

At the present time, only three low-frequency and three high-frequency television stations will be operating in most cities. In an effort to design a tuner around available parts a standard five-position switch was used.

This definitely covers the low channels, and three high channels can be covered due to the extreme range of condenser C_a. Either L_a or L_1 can be adjusted to cover more than one channel. The selectivity of L_1 and L_2 is sufficiently broad to allow such operation. A compromise adjustment of L_1 and L_2 would improve this type of operation.

The addition of an r.f. stage to the tuner would be an improvement but would complicate the construction to the point that special test equipment would be required to place the tuner in operation plus the necessary skill in actual construction.

-30-

Television Antenna

(*Continued from page* 37)

pickup signals. The reason for the high-gain antenna is that a stronger signal from the antenna will swamp the direct pickup on the chassis. The coaxial cable from the antenna should be connected directly to the internal antenna input terminals of the TV receiver through the matching transformer. The piece of balanced line between the external and internal antenna terminals should be removed. If there is still sufficient direct chassis pickup on any pattern so that it mars the picture, a metal bottom plate can be fitted to the base of the television receiver. Should direct chassis pickup still be present due to unshielded components, a wire mesh screen can be arranged about the inside of the TV receiver cabinet as a final corrective measure.

Many complex problems accompany even the average TV antenna installation, and they cannot be solved through application of haphazard techniques. It is usually less expensive to engineer an installation properly with the correct "asking price" for necessary components than to sell a low-cost installation which will subsequently have to be revised at a financial loss in order to maintain the customer's regard. A good installation completed at the very beginning will not imperil that good will.

-30-

A Compact Baffle

(*Continued from page* 57)

sions of the suspension elements (voice coil spider and cone rim annulus). Combining all these relations, we find that the maximum "undistorted" power output at any given low frequency is approximately proportional to the *sixth* power of the cone diameter! This means that at low frequencies a 12" speaker can deliver about 64 times as much useful power as a 6" speaker, and a 15" speaker can deliver about 4 times as much power as a 12" speaker. These relations do not tell the whole story, but they give an idea of the importance of using the largest possible speaker.

4. *Equalization.* In an absorbent walled conventional bass reflex or infinite baffle, the back radiation at higher frequencies is largely absorbed, while at lower frequencies it is largely reflected back to boost the bass response. In a labyrinth baffle, the back radiation comes into much more intimate contact with the lining, so a substantial portion of the back radiation at low frequencies is absorbed in spite of the relatively poor low-frequency absorption characteristics of the lining. Labyrinth baffles therefore give noticeably less bass boost than do other types. This is an advantage where a flat response is desired, and where all the audio components are of high quality. But where a strong over-all bass characteristic is desired, or where a strong bass boost is needed to offset deficiencies in some of the components, it is necessary to apply more bass boost in the tone control circuit than would be needed in the case of a conventional bass reflex or infinite baffle. It must be remembered, however, that tone compensation is effective only within the limits imposed by the moderate power capacity of our baffle. Undistorted power output cannot be increased by equalization.

5. *A Non-Absorbent Baffle.* Although the absorbent walled baffle gives a smoother response, a non-absorbent baffle can give surprisingly good results. A fairly satisfactory baffle can be made of corrugated paper or cardboard. The baffle consists of a corrugated paper box with baffle plates of the same material. The construction must, of course, be solid to avoid rattling. One way to accomplish this is to glue all joints.

To those who believe that a baffle should never be constructed of anything less substantial than three-quarter-inch plywood, this may sound like an absurdly flimsy construction. To be sure, it is inferior to a more rigid construction, as the walls and baffle plates vibrate noticeably at low frequencies, providing a partial short-circuit of back radiation tending to cancel the output from the front of the speaker. There would be little point, however, in making a non-ab-

sorbent baffle of wood, as it would be harder to make than the absorbent baffle, besides being inferior in performance.

6. *Testing the Baffle.* The ultimate test of a music reproducing system for the home is how it sounds in the home, playing music. No matter how flat its frequency response is in the laboratory, it will have resonant peaks in the home, caused by standing waves in the room. The home response thus depends as much on the location of the speaker and listeners as upon the laboratory characteristics of the reproducer. This does not mean that the laboratory values are useless. On the contrary, the more that is known about the reproducer's characteristics, the easier it will be to decide whether a defect in home response can be blamed on the reproducer or on the room, and the more readily the defect can be remedied.

If the reproducer's characteristics are to be tested by ear, using an audio oscillator, the test should preferably be run out-of-doors to minimize the production of standing waves. A less satisfactory alternative, where outdoor tests are not feasible, is to listen with the ear close to the speaker, in which case the standing waves are largely drowned out by the relatively high intensity sound reaching the ear direct from the speaker. Tests should be made not only of frequency response, but also of the power output at low frequencies. Actual music such as bass drum beats and organ pedal notes is better than pure oscillator tones for judging the adequacy of power output.

The closed acoustic labyrinth baffle which has been described above, has the following alleged advantages over other baffles:

(1) It has a smooth and extended bass response comparable with that of much larger conventional baffles, while providing more than enough output for most home purposes.

(2) It is small enough to be placed out of sight within most floor model radio-phonograph cabinets, or on a shelf behind a curtain, thus conserving space and eliminating the need for a fancy job of woodworking.

(3) It requires little skill or expense to make. —30—

NEW TV RECEIVERS ----------.on the Market

EMERSON PHONORADIO

Emerson Radio & Phonograph Corporation, 111 Eighth Ave., New York, N. Y., has announced that deliveries

are being made on the new "four-way" television Phonoradio console, Model 618.

This receiver has a 91-square-inch picture screen, using a 12½ inch television tube, in combination with FM and AM radio and including a phonograph with automatic record changer. The combination is encased in a console cabinet of matched crotch and striped mahogany veneers.

This model retails at $529.50 and is believed to be one of the lowest priced, name "four-way" 12½-inch-tube TV radio-phonograph consoles now on the market.

DIRECT CURRENT TV SETS

Introduced into the New York market by *Stewart-Warner Corporation*, 1826 Diversey Parkway, Chicago 14, Ill., is a 10-inch television set operating on d.c. only, designed to eliminate the expense and other objections to the use of an a.c. converter. It is believed this innovation will give greater image stability.

The list price of the d.c. model is the same as that of the a.c. television receiver. It was intended particularly for apartment house areas, and utilizes the same cabinet as in the *Stewart Warner* consolette, model AVT-1.

Although this set is being distributed only in the Manhattan market, it will be available on special order for dealers in other areas where need for a straight d.c. set arises.

"PROTELGRAM" THROWS IMAGE

Intended primarily for TV viewing of large groups, a television picture four feet wide by three feet high has been demonstrated by *North American Philips Company, Inc.*, 100 East 42nd Street, New York 17, N. Y. The picture was projected from a small cabinet containing a complete television receiver onto a conventional home movie screen, using a slightly modified "Protelgram" optical unit.

The "Protelgram" system can be used in conventional cabinets with built-in screens, featuring picture sizes ranging from 192 to 234 square inches. Studies by the company have shown that an image of approximately 200 square inches (20-inch diagonal) is ideal for most home applications.

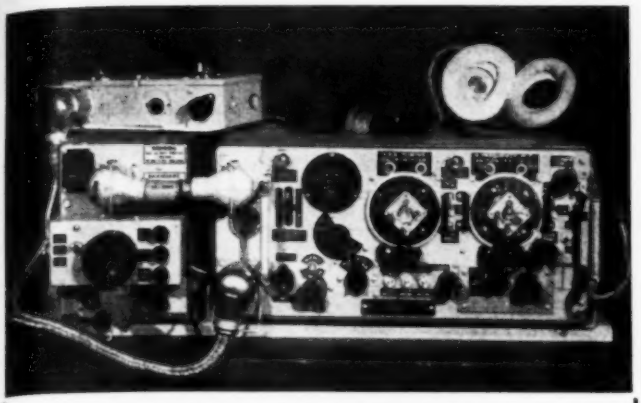
The only necessary modification of the standard unit for the demonstration was a change in the positioning and optical characteristics of the corrector lens. No increase in power supply or chassis drive is required. The second anode voltage remains at 25 kv., and any chassis which will drive the "Protelgram" unit in its present form, producing the popular 200 square inch picture, will operate it satisfactorily with the new corrector lens leading to the three by four foot picture.

NEW ADMIRAL MODELS

With the addition of seven new models of 12½-inch picture tube direct-view television combination radio-phonographs, *Admiral Corporation*, 3800 West Cortland, Chicago, Ill., now offers a line of 23 video sets and combinations that feature picture tubes from 7 inches to 16 inches.

These seven sets are offered in three cabinet stylings; five of them, in two of the stylings, are housed in cabinets the size of an average radio-phonograph combination. The basic

difference in the two is that one has double full-length doors in the modern style, while the other has only top-half opening doors. The third styling is in *Admiral's* "Credenze" motif, with extra record storage space provided on each side of the combination.



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TERMS. 25% deposit on C.O.D. orders. Prices net, F.O.B. Shipments will be made from warehouses Plattsburg, N. Y., or Montreal, Canada.

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TWIN-TRAX was the first commercially available two-channel tape recorder. Imitators have announced two-channel recorders with similar names and similar external appearances. But it's the performance that counts, not the appearance. And the performance of TWIN-TRAX recorders *cannot* be duplicated. Our leadership in the tape recording field has been undisputed since we designed the first magnetic recording amplifier in 1936.

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JUNE SPECIALS

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THERMISTOR BRIDGE—Made by Western Electric 49.50
I—222A Signal Generator 150-230 M.C. 8-15 M.C. 69.50
IE—19A Test Set for SCR-522..... 200.00
BC—906C Frequency Meter..... 17.50
Model 105S Microwave Signal Generator 375-725 M.C. 49.50
Megger—500 V.—1000 Megohms. Mod. M-1000 B. Made by Interstate Mfg. Com. MI-48B. Used $69.50.....New 99.50
Supreme Model 563—Audio Oscillator... 29.50
Test Set Type 89..... 29.50
Calibrator I-200 115 V. 60 Cycles—345 and 621 cps Western Elec. .....New 49.50
I—193A—Test Set for adjusting polarized relays—Western Elec. .....New 150.00

MINE DETECTOR—SCR-625A Used for locating metal, underground pipes, gold, etc.
NEW with manuals.....$74.50
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Antenna Relay Unit—RE-2/ARC-5 Weston Antenna Current Indicator Meter, Relay, Vacuum Condenser, Excellent condition... 2.95
Handy-Talkie Crystal and coil sets—3885 K.C. to 5500 K.C.—Specify frequency—2 Crystals and 2 Coils per set. New..... 2.25

I-82—Selsyn compass indicator, 5" 360 degree dial $2.95
Plugs will fit I-82, I-81..... .70
I-81—Selsyn compass indicator, NEW.. 3.25

WESTON Electrical Tachometer meter Model 845 for use with Model 724 Magneto. Speed 0-2000 R.P.M., Ratio 2:1. NEW..$19.50
WESTON Tachometer Generator, Model 724, Type C. Good Used..... 18.50
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APN-1 ALTIMETER INDICATOR — Basic Movement 0-1 ma., 5 ma. shunt, 270° scale. An excellent basic movement for constructing your own meters. NEW..$1.95
METER RECTIFIER, full wave midget Selenium, 10 volts, 30 ma. NEW..... .29

6" P.M. COMPARTMENT SPEAKER, 25 watts, 50-6,000 ohms. Waterproof. Used excellent $8.95

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RADIO SET SCR-624C, SCR-522 Ground Station—includes SCR-522C, Chest CH-173A, Set of tools, Chest CH-172A, RA-62C 110VAC Rectifier power supply, Chest CH-170A, Antenna AN-94A, Antenna Mast, ETC. —Complete in 6 boxes. All cables, cords and lines NEW.....$485.00
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Extension Cord, CD-307A—New with PL 55 and JK 26..... .49
Headset Adapter MC-385D—High to low impedance ..... .35
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IDEAL MOBILE POWER SUPPLY

PE 237—Heavy duty vibrator power supply, 6, 12, or 24 v. input. 525 v., 95 ma.; 105 v., 42 ma.; 6.5 v., 2 amp; 6 v., 500 ma.; 1.3 v., 450 ma.; small supply 100 v., 17 ma.; 1.35-450 ma. with tubes, shock mounted. BRAND NEW.....$29.50

EE-8 TELEPHONE FIELD SETS with handset and ringer. Good used $9.00 each....a pair $16.00

Bassett Aircraft Radios and Accessories—Two-way radio Communication—Transmitter freq. 3105 K.C.—All new equipment.
MC6A—1½ watt trans.-recr., tubes, crystal, battery case, antenna.....$31.50
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400 Cycle Inverter — General Electric 5D21NH3A—Input 27 V., 35 amps, output 115 V.—485 V.A. single phase....$12.50
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25% on all C.O.D. orders.
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NEW, Export packed.....$19.50
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Transmitter only, tubes..... 5.95

CD-501A CABLE for PE 103A-BC654A..$1.95
RM-29 REMOTE CONTROL UNIT, RINGER —NEW 8.75

BC 357 J—BEACON RECEIVER, 75 mc., tubes. NEW .....$ 3.45
MN 26C—RADIO COMPASS RECEIVER, tubes 150-1500 kc. 17.50
BC 464—TARGET RECEIVER, 5 channel remote control, battery case and ant. 68-73MC. NEW 14.95
INTERPHONE AMPLIFIER—BC 709; Ideal for Aircraft, booster for telephones, etc. NEW 4.50
INTERPHONE AMPLIFIER — CMX50128A, 12 v., 6 watts output P.O. TCS equipment with tubes and dynamotor. NEW... 8.50

TRANSFORMER: 5 v. at 190 amperes; 115 v., 60 cycle input. USED.....$12.95
200-0-200 at 50 ma.; 6.3 v., 3 amps, output, 115 volt, 60 cycle input—NEW 2.50
100 watt Class B modulation transformer P.O. BC 375. NEW..... 2.95
PEERLESS HQ-20 line matching transformer, 50/125/200/500 ohms. NEW 1.50

TUBE SPECIALS

1A5	$0.55	VR150	$0.90	249C	$ 1.75
5U4G	.55	E1148	.90	304TL	.80
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6H8G	1.05	2J21	9.50	801	.85
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6K7G	.60	2J26	9.50	807	1.25
6K8G	.90	2J27	9.50	837	1.50
6L6G	.90	2X2	.75	849	39.50
6SH7	.35	5BP1	1.95	891 Amperex	
6SL7GT	.89	5BP4	2.50	NEW	100.00
6SN7	.55	5CP1	2.50	954	.35
6X5GT	.55	RKR72	1.25	958	.50
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12H6	.35	30	.79	1625	.35
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Transformer—Secondary 6200 V @ 325 ma. Easily C.T. for 3100-0-3100v. @ 650 ma. Primary 105/110/115 VAC—American Transformer Corp. Instructions included..$49.50
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.02 mfd—8,000 V.D.C. Oil Cond.—Aerovox M12..	$1.39	.01 mfd—5,000 V.D.C. Oil Cond.—Aerovox M12..	.69
.1 mfd—3,000 V.D.C. Oil Cond.—Aerovox M12..	.79	.5 mfd—2,500 V.D.C. Oil Cond.—Aerovox N12..	.95

All of the sets are equipped with the new "Triple-Play" phonograph that automatically plays with one tone arm all sizes of all records, both microgroove and standard, at all the turntable speeds on the market: 33⅓, 45, and 78 r.p.m.

In addition, all the sets have a specially designed, built-in turret tuner, originated by *Admiral*, that permits complete television channel coverage.

"THE BELMONT"

Television, radio, and phonograph, all forms of electronic home entertainment are provided in the Model 10AXF43, featured by *Raytheon Manufacturing Co.*, 60 East 42nd St., New York 17, N. Y. It is provided with *Raytheon's* Hi-Fidelity FM-AM radio, 20/20 super-circle television, and the new 45 r.p.m. microgroove automatic record player.

The entire surface of the 10-inch picture tube is utilized, and the circular screen thereby presents a 70 square-inch direct-view image. The Hi-Fidelity "ratio detector" FM and standard broadcast receiver with a voltage-doubler circuit provide extra power needed for true-to-life tonal response.

The 45 r.p.m. record changer incorporated in "The Belmont" automatically plays eight of the new seven-inch Vinylite non-breakable records.

Of contemporary design, the cabinet is finished in hand-rubbed mahogany veneers, and the television panel meets the eye at a level suitable for maximum comfort from a normal sitting

position. All TV and radio controls are on the front panel. The size of the cabinet is 33⅞ by 34 by 39¼ inches.

DU MONT'S DE LUXE "MANCHU"

Newest addition to the *Du Mont* line is a de luxe television receiver model featuring a twenty-inch tube recently announced by the *Allen B. Du Mont Laboratories, Inc.*, 515 Madison Ave., New York 22, N. Y.

The "Manchu" is compact in design and offers a very large direct-view tube, with a screen of 213 square inches, AM and FM radio, automatic record changer for standard and LP records, and a high-fidelity audio system employing dual speakers for full-range reproduction.

Installation of the receiver equipment has been made in a cabinet

mounted on a teakwood table that rotates on a specially designed swivel mechanism, which permits the screen to be turned to any desired viewing position while the cabinet base remains flush against the wall.

One side and end of the cabinet is in beautifully grained mahogany, while the other side and end is finished in an antique Chinese jade lacquer. Heavy brass hardware is used on all four sides, and either the mahogany or jade surfaces may be employed as desired to complement the decorative motif of any room.

GAROD CONSOLETTE

Employing a 15-inch cathode-ray tube, a "Tele-Zoom" picture magnifier, and AM and FM radio reception, the new television consolette announced

by *Garod Electronics Corporation*, 70 Washington Street, Brooklyn 1, New York, comes in mahogany ("The Grand") or in a bleached mahogany version ("The Moderne").

According to the manufacturer, this is the lowest price 15-inch instrument in the de luxe consolette category, and when the normal 15-inch rectangular picture is enlarged to a circular close-up by pressing the "Tele-Zoom" control, the user has an image which is larger than the one reproduced on 20-inch tube receivers.

"The Moderne," Model 15TZ9, has a cabinet measuring 24 inches wide, 21½ inches deep, and 43 inches high.

MECK TEN-INCH TV RECEIVER

The *John Meck Industries, Inc.*, Plymouth, Indiana, manufacturers of low-priced radio and television receivers, announces the production of a new

10-inch television set offering a 65 square inch picture.

Greater detail is provided by a new automatic frequency control system, and high-voltage power with improved regulation makes possible better contrast and increased brilliance.

The set, Model XL-750, has a cabinet of hand-rubbed mahogany measuring 15 inches high, 21 inches wide, and 19 inches deep.

FIVE-IN-ONE CONSOLE

A new television console (Model 9TW333), the first television receiver incorporating the new 45 r.p.m. music reproducing system, was announced by the *Radio Corporation of America, RCA Victor Division*, Camden, N. J.

The five-in-one combination offers 10-inch, direct-view television, standard and *RCA Victor* FM radio reception, and separate systems for the reproduction of 78 r.p.m. records, and the new 45 r.p.m. discs.

The console features *RCA Victor's* "Eye Witness Picture Synchronizer" and automatic multi-channel selector switch for television, five watts of push-pull power output, a standard "Silent Sapphire" permanent-point jewel pickup for the 78 r.p.m. record player and a miniature counterpart for the new 45 r.p.m. system, built-in antennas for the AM and FM radio bands, and thirty tubes and three rectifiers.

Although housing five entertainment units, Model 9TW333 measures only 40 inches high, 41½ inches wide, and 23 inches deep.

PLASTIC TV CABINET

Molded in rich rosewood of *G-E* phenol formaldehyde plastics material, one of the largest plastics cabinets has been fabricated by the *General Electric Company*, Plastics Division.

The housing was designed for a new low-priced table model television receiver produced at *G-E's* Electronics Park, Syracuse, N. Y., and is

molded in two parts, weighing eleven pounds. The largest section is 15 inches high, 11½ inches wide, 17 inches deep, and has an average wall thickness of 3/16 inch.

The chassis of the set, with its 10-inch picture tube, is assembled to the plastics face panel and then locked through an opening in the back of the deep plastics case. The face of the cabinet has a generous picture opening framed with a projecting head. The receiver itself contains a simplified circuit which necessitates only 17 tubes and 3 rectifiers in addition to the ten-inch picture tube. —30—

PORTIONS OF THE 160-METER BAND RE-OPENED

ALTHOUGH the case for restoration of 160-meter privileges looked hopeless for a long time, the FCC has finally opened portions of this band for limited operation effective April 7, 1949.

By Commission order FCC 49-188, dated February 17, 1949, Section 2 104 (a) of the Commission's rules was amended to show the frequency allocation of 1800-2000 kc. on a shared basis between Amateur Radio Service and Radio Navigation (Loran) Service subject to detailed conditions and limitations applicable to the Amateur Service, as follows:

(a) Mississippi River to East Coast U.S. (except Florida Gulf Coast states): 1800 to 1825 kc. and 1875 to 1900 kc., using type A-1 or A-3 emission. Power input to the plate circuit of the tube or tubes supplying power to the antenna shall not exceed 500 watts day, 200 watts night.

(b) Mississippi River to West Coast U.S. (except states bordering Gulf of Mexico): 1900 to 1925 kc. and 1975 to 2000 kc., using type A-1 or A-3 emission. Power input to the plate circuit of the tube or tubes supplying power to the antenna shall not exceed 500 watts day, 200 watts night, except in the State of Washington where daytime power is limited to 200 watts and nighttime power to 50 watts.

(c) Florida and states bordering Gulf of Mexico: 1800 to 1825 kc. and 1875 to 1900 kc., using type A-1 or A-3 emission. Power input to the plate circuit of the tube or tubes supplying power to the antenna shall not exceed 200 watts day, no operation at night.

(d) Puerto Rico and Virgin Islands 1900 to 1925 kc., and 1975 to 2000 kc., using type A-1 or A-3 emission. Power input to the plate circuit of the tube or tubes supplying power to the antenna shall not exceed 500 watts day, 50 watts night.

(e) Hawaiian Islands: 1900 to 1925 kc. and 1975 to 2000 kc., using type A-1 or A-3 emission. Power input to the plate circuit of the tube or tubes supplying power to the antenna shall not exceed 500 watts day, 200 watts night.

(f) The use of these frequencies by stations in the Amateur Service shall not cause harmful interference to the Loran system of radio navigation. If an amateur station causes such interference, the station licensee shall, as directed by the Commission, immediately cease operation on the frequencies involved.

A large part of the credit for the restoration of these operating privileges is due to the untiring efforts of NARC. Nice going, fellows.

—30—

Technical BOOKS

"POST WAR COMMUNICATIONS RECEIVER MANUAL" by Sams Staff. Published by *Howard W. Sams & Co., Inc.*, Indianapolis. Price $3.00.

This book has been designed for radio amateurs, professional operators, aircraft radio technicians, and short-wave listeners. Service data on most of the communications receivers produced in the period from the end of the war to mid-summer of 1948 have been included.

In addition to this service data, which appears in "Photofact" form, aligning and other adjustment information is given for the various receivers. One particularly valuable service rendered by the book is that of giving a list of standard replacement parts which may be used in the receiver being analyzed. Complete voltage and resistance charts are provided to facilitate servicing and adjustment of the receiver.

Thirty communications receivers, manufactured by *Collins, Gon-Set, Hallicrafters, Hammarlund, National,* and *RME* are covered in the text. In addition aircraft and marine radios from *Airadio, Hallicrafters, Harvey Wells, Heath, Jefferson Travis, Learadio, Motorola,* and *Ranger* are discussed and diagrammed.

Although such a brief description hardly does justice to such a text, those who will find it of the most value will be able to judge it best in the operating shack.

* * *

THE RADIO AMATEUR'S HANDBOOK (26th Edition, 1949). By headquarters staff of the *American Radio Relay League,* West Hartford, Connecticut. 736 pages. Price $2.00.

This internationally recognized standard manual of amateur radio communications has been carefully revised and brought thoroughly up to date. Its twenty-five chapters cover the entire field from basic fundamentals to the latest techniques in single-sideband telephony.

In the time-tested Handbook pattern, the first four chapters are devoted to the history of amateur radio, electrical laws and circuits, vacuum-tube principles and data on high-frequency communication. Additional fundamentals are presented in conjunction with constructional chapters, and the student is given practical applications of the theory as he learns it.

A handy new section on practical filter design is included in the power-supply chapter which has been rearranged for maximum readability. Amateur very-high-frequency, ultra-high-frequency, and microwave techniques and equipment are covered in a five-chapter section.

Altogether, the Handbook is quite valuable for its well-organized information on assembling an amateur station, eliminating broadcast and televi-

sion interference, recommended station operation practices, emergency operation and message handling, and fills current needs as a radio construction manual, reference work, and training text.

* * *

RADIO FUNDAMENTALS, by Arthur L. Albert. Published by *McGraw Hill Book Co., Inc.,* New York. 595 pages. Price $4.50.

Much of the material in this book was developed and expanded from lecture notes and problems which were being used in college and wartime radio courses. It is designed as a text for students who have not had electrical courses and thus is amply supplied with diagrams and illustrations. Summaries, review questions and problems follow each chapter.

Before entering into such subjects as oscillators, transmitters, vacuum tubes, and rectifiers, each of these being thoroughly covered in their respective chapters, the book discusses the fundamentals of acoustics and of electricity.

Upon mastering these very important chapters, with the aid of problems and review questions the student is led by progressive stages through the sections on circuits and power transfer and impedance matching, into the more complicated aspects of radio operation.

Television is but very briefly touched upon; the entire book is devoted to radio and is very well suited to the needs of those interested as a hobby, or those wishing thorough grounding in the subject as a prelude to repair and servicing.

* * *

THE AMPLIFICATION AND DISTRIBUTION OF SOUND, by A. E. Greenless, A.M.I.E.E. Published by the *Sherwood Press,* Pacoima, California. 302 pages. Price $6.00.

This edition is intended to present a general survey of the principles of sound amplification and distribution for those engaged or interested in the planning, installation, or operation of sound-amplifying equipment. It can be recommended as an introduction for the beginner, or as a work of reference for the established public address engineer.

No advanced knowledge of mathematics is necessary to follow the text, and mathematical treatment of the subject has been introduced only where necessary. Proceeding from the study of fundamentals, this chapter having been included for the sake of completeness, the manual continues to the study of amplifiers, their special features, and their power supplies and performance. Radio receivers, microphones, record reproduction, and loudspeakers next come in for a share of attention, and the book concludes with discussions of installation planning, operation, and maintenance of equipment and testing devices.

This edition, being a revision and enlargement of the original, includes latest developments in the field of sound. —30—

Bandswitching V.F.O.
(*Continued from page* 35)

Regardless of the theoretical stability of any oscillator, it still does not relieve the constructor of the necessity for using care in his work. Hams building any v.f.o. should see that all parts are mounted solidly. In the writer's unit, No. 14 solid wire was used for r.f. hookup. Supply wiring was cabled of No. 20 flexible, insulated wire. Tie points, cable clamps, lockwashers, and other constructional features which make for mechanical stability were used. When winding the coils, the largest wire was used which would fit the given form. One end was tied to a door knob and the required length unwound, stretched and wound on the form under tension. The final coils were given a light coat of Quartz Q coil dope and left to dry thoroughly before being used.

After construction and wiring was completed, the circuit was checked for correct continuity of wiring. This practice often saves grief and money on any job, as one error in wiring can cause plenty of trouble. Before turning on the power supply, the voltage regulator tap was set down on the voltage divider. Power was then applied and the slider moved up toward the high end until the VR tube ignited and remained ignited under key-up or down conditions.

From this point it was necessary to bring into use the receiver, wavemeter and a frequency meter. The popular surplus BC 221 frequency meter was used for calibration, and it does an excellent job. It is probably the most accurate frequency meter available to the average ham. A secondary frequency standard having output signals on 10, 100 and 1000 kc. would also be an excellent calibrator, but there are not many of them around that the average ham can borrow for one job. The BC 221 will indicate 1 kc. points in the 80-meter band, but this is a bit closer than necessary. Marks at each 10-kc. point on the 80-meter dial are entirely adequate. Starting with the 80-meter band, all oscillator padders were adjusted so that the desired bands of frequencies were centered on the *National* SCN dial. Then the doubler padders were adjusted for maximum output. These padders may require touching up when the v.f.o. is coupled to the rig. As was mentioned earlier in the article, some adjustments were necessary on the coils to allow perfect tracking.

Final tests with the author's unit showed that drift during warm-up was very small, amounting to only about 250 cycles on the 80-meter band. Changes in line voltage produced absolutely no change in oscillator frequency, even with the extreme downward surges caused by the starting of the refrigerator or oil burner. Loading appears to have negligible effect on the frequency. One remarkable

feature was that the stability on band 3 was just as good as it was on band 1. As for keying, it would be impossible, on any band, for a listener to distinguish the v.f.o. from the best crystal oscillator, as there is no chirp or drift whatsoever, even with the final in operation. As for power output, the drive is sufficient to excite a 6L6 or 807 as a buffer or multiplier. It is well known that the best stability in v.f.o.'s is coincident with low-power levels in the first stages.

To place the exciter in operation, it is necessary to connect 117 volts a.c. to terminals 5 and 6. Terminals 3 and 4 supply operating voltage to 117-volt a.c. relays when the send-standby switch is thrown to "send" position. At the same time, the circuit to terminals 1 and 2 is opened, disabling the receiver. To operate the v.f.o. without energizing the high-voltage relays or killing the receiver, it is only necessary to operate S_4. In this way, the unit may be tuned to any frequency within a band with the high power off. Ofttime cursed is the ham who tunes his v.f.o. across the band with his antenna radiating half a kilowatt or so. The best way to excite an 807 or 6L6 buffer stage operating straight-through is to remove the crystal or grid coil and connect the hot side of the v.f.o. output to the grid through a .0001 μfd. condenser, while grounding the other side of the link. If operating the following stage as a multiplier, it will be necessary to couple the v.f.o. to the grid through a circuit tuned to the v.f.o. frequency, while tuning the plate circuit of the multiplier to the desired output frequency. The tuned-grid circuit is not desirable, however, when operating the 807 or 6L6 straight-through, as the stage is liable to "take off" as a tuned-plate-tuned-grid oscillator. Of course, the v.f.o. can be tuned a reasonable distance either side of the center frequency without retuning the following stages, but don't expect to be able to move from one end of the band to the other without retuning.

The author's transmitter, which, incidentally, was described in the July, 1946, and November, 1947, issues of RADIO NEWS, is presently being controlled by the v.f.o. —30—

"Stanley . . . put that television magnifier back immediately!"

LETTERS from our readers

CONTESTANTS, HERE'S FOOD FOR THOUGHT

"THE prizes to be awarded in the New Ham Contest are certainly generous and well worth working for. I would like to pass along a suggestion that may be of real value to those contestants who will take advantage of it.

"In nearly every city there is a large group of men in all age brackets who are excellent prospects. These men have all of the desirable qualifications for prospective hams. They have lots of spare time but little opportunity for human contact, a deficiency they are burning to remedy.

"I refer, of course, to chronic invalids. There are more of these than you might think, confined to home or hospital. Perhaps the most important thing that can be said about these people is that they are full of human nature. They think and react just as do physically fit persons and have the same range of tastes.

"This means that the men and boys among them are apt to be hobby-minded and technically inclined, just as most men are. It also means that in most cases they are easy to meet, to know, and to get along with. You have only to approach them as human beings and treat them as equals.

"Veterans' hospitals are the first place to look. Here you will find prospects in wholesale lots, with opportunities for group instruction as well as trained workers, the occupational therapists, who are eager to help you in your task. Civilian hospitals tend to have few permanent patients, but among them are those in iron lungs, an appalling number of whom will be there the rest of their lives. Looking at the ceiling gets kind of dull after a while, and it shouldn't be hard to get an iron lung occupant interested in radio. This assumes that he has good control of one hand or foot, which is actually all that is necessary to make a radio contact. By the way, c.w. is the most practical for these individuals. Phone would be awkward.

"Besides hospitals, there are other institutions, such as schools for the blind, where you can find likely prospects. Various social and civic agencies will put you in touch with persons confined to their homes. One of the beauties of this scheme is that support and cooperation will be available wherever you turn. Even the FCC will stretch a point here and there. Many local newspapers would be delighted to team up with radio clubs in organized drives to license invalids.

"It can be said, in all sincerity, that individuals and club members who follow the above suggestions will have hit upon an excellent means for picking up extra contest-points. But they will have accomplished vastly more than that. Even if they fail to win RADIO & TELEVISION NEWS prizes, they will wind up the contest in firm possession of rewards of a different sort."

Warner Clements, ex 9FQX
Sherman Oakes, Calif.

Anyone who follows through on your very generous and intelligent idea, Warner, will indeed come out in possession of a mighty fine reward.

* * *

AN APPEAL

"AS MEMBERS of the great amateur fraternity of radio operators in the United States, we are privileged to enjoy the opportunity of chatting with our fellow hobbyists via radio communications. The art as we hams practice it has enough scope to enable most of us to have a reasonably good time of it, whether our tastes run to c.w. or phone, or mostly experimentation and/or the frequent combination of these three.

"Due to the generous allocation of frequencies by the FCC, we have a wide choice of operating conditions in which to enjoy our hobby. Also, since we have the kilowatt as our power limit, most of us are able to strike a happy medium between our desires and our pocketbooks, assuming that for the majority the kw. is sufficient. Now, assuming that the above statements are sufficiently true to satisfy most of us, it would seem to be an obvious fact that American amateurs have more privileges and are better able to enjoy same than, perhaps, the amateurs of any other country. This is due principally to our economic status, which is still pretty good in spite of what some of the pessimistic observers would have us believe. Another contributing factor, of course, is the fact that there are many radio manufacturers who are amateur-minded and who cater to our desires with excellently fabricated components.

"With all of the foregoing concepts of our position clearly in mind, the writer has a proposition to make, a somewhat sporting proposition, since it is an appeal to the better sides of our natures, the side that favors the underdog. It will not necessarily benefit the individual operator, except perhaps indirectly. How about giving the small-time operator a break, the fellow who might not have much dough to sink into radio gear, the fellow who is just starting in as an amateur, as well as the fellow who likes a phone QSO but can't compete financially and technically with the 'half-gallon to a

kilowatt' boys on our low-frequency bands.

"We have just been allocated some frequencies in the 160 meter band. Not much. Just some bands that are 25 kilocycles wide. These we are to use on trial, so to speak, although they will probably be ours if we behave ourselves. Now my proposition is this: how about setting a voluntary limit of power input to the final of between 25 to 50 watts? From our viewpoint there would seem to be several reasons why this would be feasible and practicable to enable most hams to get the most out of the band. The frequency limitations are very small, and if just a very few high-power stations are on the air in a given area, it will effectively exclude all others. It is primarily a short-haul band, and even if power input is the maximum, there can be no real DX.

"If the average station will limit himself voluntarily to the above mentioned power maximum, it would appear that most stations would be able to work the guy across town and maybe outside somewhat. A good part of the possible QRM troubles will be eliminated as well as the BCI trouble. This band with power limitations could well be a good source of inspiration to the beginning amateur, and since there has been a real effort on the part of radio publications to build up the population of hams by their programs for newcomers, it would seem that this would provide a partial solution for the problem of where all the new hams will go.

"Before we sign off on this subject, we would like to give a specific instance of how power works on this band. From our location in Eastern Massachusetts, we have heard a station in New York near Albany coming through S 7 to 8 at 7:30 PM working a W3 in Pennsylvania. The W2 had 160 watts to an 813 in the final and was readable 100 per-cent of the time. He was occupying at least one-third of the 25 kc. sector (low frequency) and succeeded in taking two local stations within a 25-mile radius completely out of the picture. The local stations were coming in at the time, S4 and S5. They were both using very low power, needless to say. We could have worked the locals with 25 watts but not if the W2 was going to be on at the same time.

"So how about it fellows? How about giving the little fellow a break on this band. Since you can't work DX anyway—as more power just invites BCI troubles—since there are a lot of low-power boys who could get a lot of fun out of this band by your keeping the power down—why not 'live and let live' so that we *all* get some pleasure out of these new frequency allocations."

R. L. Parmenter, W1JXF
Roosevelt Ave., RFD 3
Middleboro, Mass.

If any of you luckier boys have been operating your powerful rigs at full

blast, maybe you could take this little hint and just once in a while impose the power limit on your XMTRing.

• • •

UNDEMOCRATIC HAMS?

"THE greatest single threat to amateur radio lies in the success or failure of the attempt to induce the FCC to raise the code speed requirements for amateur operators' licenses.

"Raise the code speed requirements or restrict the newcomer to code for one year, and amateur radio will be so exclusive that its extinction will become inevitable. Reduce the code speed requirements to 10 w.p.m., and amateur radio's position will be strengthened.

"The examination for an amateur radio operator's license should be designed to test the applicant's ability to operate amateur radio transmitting equipment. Requirements designed solely as a barricade have no place in the examinations and are unfair and undemocratic.

"It would seem that amateur radio is being misrepresented by some who claim to be its spokesmen. Speak up amateurs, what do you want? We who are striving to qualify for a license ask only the same chance you were given. Don't change the rules to exclude us, please."

C. D. Flynn
3118 N. Francisco Ave.
Chicago 18, Ill.

We hope the proponents of higher exam. requirements do not intend to be unfair, but it could look like that, so let's hear from the other side, too.

• • •

THAT POPULAR 10 w.p.m. AGAIN

"IN REPLY to Marvin Gurlin's letter in the April issue, I think that he said a mouthful.

"I'm very much in favor of making the amateur exam. simpler instead of stiffer as some groups would have it. If the truth were known, it would be found that there was a higher percentage of c.w. operators under the 10 w.p.m. speed then than there is now.

"Many of the 'old timers,' worried about the number of new hams crowding into our bands, would like to eliminate competition by making the exam. tougher. I have found that a newcomer must put out a fairly good signal or he just doesn't make contacts, and it doesn't take long to discourage the few poor risks this way.

"Don't put up barriers that scare new, and especially young, operators away from at least a fair start in this wonderful hobby.

"Yours for better hamming,"

Bob Fisher, W6EUZ
Seal Beach, California

Maybe those young hams do need more encouragement. We'll do all we can, but there must be more fellowship in our ranks than these youngsters seem to think. Why don't some of you "old timers" show them and lend a helping hand? —30—

What's New In Radio

(*Continued from page 78*)

iron, and thereby effect considerable labor savings; economy results from the use of less solder, and from its instant operation, with no waiting to warm up. It is effective from 14 to 30 gauge copper wire and can be used to silver braze small metal parts.

R-4A COAXIAL SWITCH

A single-position, four-throw switch for use with coaxial cable has been produced by *The Workshop Associates,*

66 Needham St., Newton Highlands, Mass.

This switch was designed especially for use with television transmission lines but can also be used effectively in any r.f. application up to 350 mc. and in low-level audio systems.

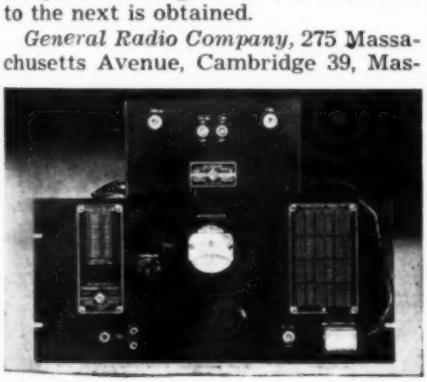
The Model R-4A can be used with RG-11/U and RG-8/U as well as with RG-59/U coaxial cable, by using *Workshop* coaxial fittings and adaptors.

INTERPOLATING FREQUENCY STANDARD

Designed particularly for use with the Type 720-A Heterodyne Frequency Meter, the *General Radio Company's* Interpolating Frequency Standard will make accurate measurements at ultra-high-frequencies up to about 3000 megacycles.

The instrument provides a series of harmonics of a nominal one-megacycle signal whose fundamental is adjustable over a range of one per-cent. At the 100th harmonic and above, complete coverage from one harmonic to the next is obtained.

General Radio Company, 275 Massachusetts Avenue, Cambridge 39, Mas-

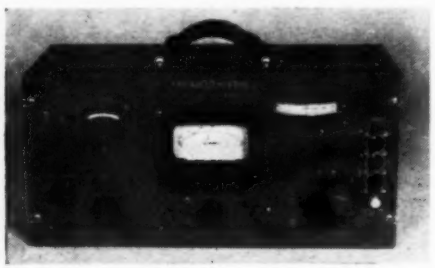


sachusetts, announces that an additional series of harmonics, based on a .1 megacycle fundamental, is also generated by the device for use with its Type 620-A Heterodyne Frequency Meter, on measurements in the range between 10 and 300 megacycles.

The adjustable frequency generated by the Interpolating Frequency Standard is determined primarily by a quartz-crystal oscillator. If increased accuracy is desired, the system can be standardized periodically in terms of standard-frequency radio transmissions from the National Bureau of Standards Station WWV.

RADIO FREQUENCY OHMMETER

The Type YKS-1 ohmmeter developed by the Specialty Division of the *General Electric Company* at Elec-



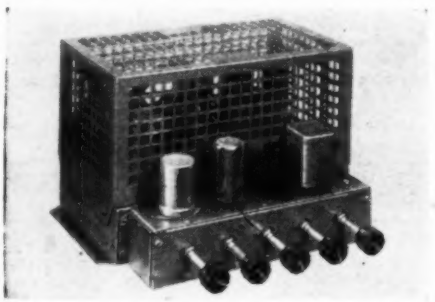
tronics Park, Syracuse, New York, is designed primarily to permit rapid and accurate measurement of r.f. resistance in coils, condensers, transmission lines, and antennas.

This direct-reading instrument has a range of from 50 kc. to 80 mc., and by means of a calibrated precision condenser provides a measurement of the series resonant reactance of the component under test. It will even measure the loss factor of fused quartz, and the more complex combinations of radio components.

HI-FIDELITY PHONO AMPLIFIER

Designed expressly for custom installations is the new *Rauland* 1825 high-fidelity phonograph amplifier having a detachable remote control preamplifier constructed to mount in any position to meet the mechanical requirements of any installation.

Another feature of the Model 1825 is a five-position frequency cut-off for elimination of needle scratch and noise. A single control provides five steps of frequency cut-off and proper setting of the control restores the original clarity to favorite recordings.



In addition to the master volume control, an auxiliary volume control on the power amplifier prevents "cramping" of the main volume control and improves signal-to-noise ratio.

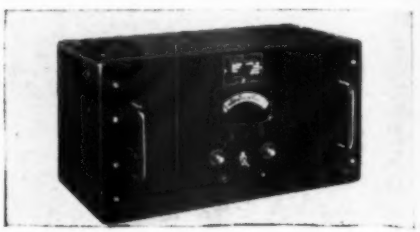
This amplifier, manufactured by *Rauland-Borg Corporation*, 3523 Addison St., Chicago, Illinois, delivers a power output of 25 watts, with not more than 5 per-cent total harmonic distortion. Frequency response is plus or minus one db., 40 to 20,000 c.p.s.; output impedances are 4, 8, 16, 250, and 500 ohms.

"STABILINE" VOLTAGE REGULATOR

The *Superior Electric Company* of Bristol, Connecticut, announces the production of a new, small automatic voltage regulator rated at 2000 v.a. output, listed as the "Stabiline" Type EM 4102.

This regulator is electromechanical in operation and consists of a *Superior* electric "Powerstat" variable transformer controlled by an electronic detector. According to the manufacturer, it has a higher response speed than heretofore obtainable in automatic voltage regulators of comparable characteristics, and only three seconds are required to correct for the wide-line voltage excursion of 95-135 volts. The new design of the enclosure (the unit is offered as a cabinet contained or rack-mounting unit) is said to make all parts more accessible for maintenance and replacement.

The "Stabiline" is housed in a cabinet measuring 20$\frac{9}{16}$ by 10$\frac{3}{4}$ by 9$\frac{3}{4}$ inches; on the front panel is a four-



inch voltmeter, an "on-off" switch, pilot light, and screwdriver adjustments for output voltage and sensitivity.

CATHODE-RAY OSCILLOGRAPH

A new high-sensitivity cathode-ray oscillograph, Series ES-500, has recently been introduced by *Precision Apparatus Co., Inc.*, 92-27 Horace Harding Blvd., Elmhurst, L. I., New York. It is a 5" laboratory type with extended range and voltage regulated amplifiers for multi-purpose AM, FM, and TV applications.

Twenty millivolt vertical amplifier sensitivity permits direct alignment and/or adjustment of low-gain circuits and examination of minute signal levels. Among other features of the Series ES-500 are direct linear internal sweep coverage from 10 cycles to 30 kc., compensated multivibrator circuit, three position, "internal, external, line" sync selection, and a built-in phasing control.

The chassis panel is deep-etched anodized aluminum, and the over-all dimensions of the heavy gauge steel cabinet of fine dull black ripple finish are 8¼ by 14½ by 18 inches.

KILOVOLTMETER

Manufactured by the *Bradshaw Instruments Co.*, 348 Livingston St., Brooklyn 17, N. Y., the Model 4000, called the Kilovoltmeter, makes possible the measurement of television

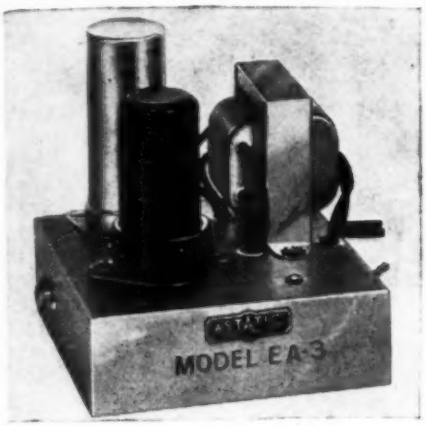
and x-ray voltages up to 50,000 volts d.c. It has an input impedance of 1250 megohms, and the basic sensitivity is 50,000 ohms/volt.

Personnel handling the instrument are in no danger, as they are protected from high voltage by the shielded Polystyrene Probe, test leads are shielded, and the shields are connected together for greater safety.

NEW EQUALIZER AMPLIFIER

The Equalizer-Amplifier, Model EA-3, latest addition to the *Astatic Corporation's* units for use in connection with its Magneto-Induction Pickup Cartridge, makes a total of three such accessory items produced by this Conneaut, Ohio, firm.

With the advent of the new long-playing records, the Magneto-Induction Cartridge was developed by



Astatic to fit the new requirements. The Model EA-3 is a self-powered unit, providing "bass-boost" and equalization to adapt the Cartridge to standard phonograph input circuits.

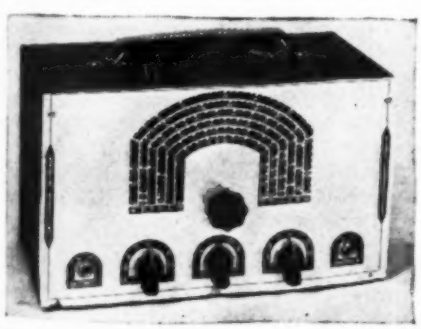
NEW DISPLAY UNIT

Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey, has introduced a counter and window display unit, featuring an accompanying reference guide for the twelve assorted Quietone Filters being shown.

The reference guide lists the filters on display with their applications and slips into the back of the display unit to be used by the salesman whenever needed. The filters sell from 75 cents to $2.25 each, and the total retail price of the kit is $16.10.

GENERATOR KIT

Radio Kits, Incorporated, 120 Cedar Street, New York 6, N. Y., has re-



leased its Model SG2 signal generator which fulfills every servicing need from 150 kc to 32 mc.

With harmonics it covers the television and FM band up to approximately 100 mc. A 400-cycle audio is available for modulation or audio testing.

The kit has every part necessary, and it is provided with blueprints and step-by-step instructions to permit construction even by a beginner.

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Spot Radio News

(Continued from page 16)

ice and serve as a source of essential propagation information required to set up a permanent allocation plan. Such a program would ease the economic problems involved in research and study, according to Goldsmith, with sponsored time supporting, in part, the expenses of ultra-high operation. The immediate allocation plan would be of invaluable assistance to the FCC, who have neither the staff nor the broadcasting facilities to engage in the vast studies required to prepare a complete ultra-high program now. Goldsmith believed that the immediate commercialism of ultra-high channels would cut years of confusion off the ultra-high allocation problem and bring the service into a cycle of quick public acceptance.

In a round-table session at the NAB, during which members of the engineering departments of FCC and broadcasters participated (John A. Willoughby, FCC acting chief engineer; Edward W. Allen, Jr., chief of the FCC technical information division; James E. Barr, chief of the FCC standard broadcast division; Cyril M. Braum, chief of the FCC FM broadcast division; Edward W. Chapin, chief of the FCC laboratory division; and A. James Ebel, WMBD; E. K. Jett, WMAR; K. W. Pyle, KFBI; O. W. Towner, WHAS; E. M. Johnson, Mutual Broadcasting System, and Frank Marx, American Broadcasting System, all of whom are members of the NAB engineering executive committee), it was disclosed that the audio tuning problem at the ultra-highs is more acute than the video, and perhaps the Intercarrier system may thus be the more appropriate tuning method since it simplifies tuning. The synchronized carrier system also came up for a bit of discussion at the quiz session. Members of the FCC group indicated that this approach, sought as the answer to the very-high allocation problem, did not solve the interference difficulties encountered on adjacent channel operation or from radiating oscillators. The sync system was of material help on co-channel operation, FCC and the broadcasters indicated.

THE STRIKING GROWTH of TV was described effectively during the annual sales conference of the *Edison Electric Institute* in Chicago by Fred A. Compton, general sales manager of the *Detroit Edison Company,* who declared that in Detroit . . . "We have been informed that television sales presently comprise from thirty per-cent to as much as fifty per-cent of the major appliance business."

Compton suggested that the utility men set up channels for the exchange of TV information within the industry and, in addition, maintain trained personnel who will be at all times familiar with TV set use and servicing problems. Stressing the acceptance of TV, Compton pointed out that even those anticipating TV reception have begun to buy, with 50,000 receivers sold in areas where stations are still under construction.

Commenting on the increased power income which has resulted from the use of television receivers, Compton said: "During the past year our television customers' bimonthly bills increased 18.3 per-cent, of which 11.2 per-cent was due to television."

IN ANOTHER PERTINENT report on TV and its impact on the economy of the nation, Dallas W. Smythe, University of Illinois economics professor and former assistant chief accountant in charge of economics and statistics for the FCC, said that by 1958, up to $15,000,000,000 will have been invested in television. The economic implications of this new industry will affect many fields of business, Smythe declared. He pointed out that even collegiate football might be affected. In the case of the larger schools, through the sale of time, there would be some profit, but in the instance of the smaller universities and colleges, the results might not be so encouraging.

In the opinion of Professor Smythe, television will eventually replace most standard broadcast transmission.

IN CONTRAST TO Smythe's comments on the effect of TV on AM radio, Dr. Frank Stanton, CBS prexy, said at the 37th anniversary banquet of the IRE in New York City that TV will not replace AM.

Dr. Stanton declared: "It is a matter of record that no mass medium once developed has ever disappeared . . . Each has its own mass appeal, its own availabilities, its own use. And there are far too many millions of Americans, with too many different tastes and desires and moods at different times of the day, for any one medium to serve them all. . . . When radio first flourished many people felt it would do away with, or seriously hurt, newspapers, movies, magazines and phonograph records. All have grown since the advent of radio, as the wealth and population and leisure time of the nation have grown. And I see no good reason for thinking the advent of television will fundamentally change this."

CAR TV has become the basis of many proposed bills in nearly half the states of the nation, which would limit or

restrict the use of television in autos.

Some of the bills are quite detailed and specific. For instance, the Rhode Island measure says that . . . "No person shall operate, or cause, or permit to be operated, any device commonly known and described as a television or video receiver within any motor vehicle upon any public highway . . . Every person who shall violate any of the provisions . . . of this chapter . . . shall be punished by a fine of not more than $50.00 for each such offense."

Modified bills, simply restricting the manner of operation and installation of the receiver, are pending in several states, including New York and California. In New York, the bill provides for placement of the receiver so that it shall not be visible to the driver while operating the car.

While none of the bills have been adopted, the consensus is that many states will enact car TV legislation of the New York restrictive type, in the belief that these acts will prevent accidents which may result from any sustained attention to the video screen.

THE BROADCAST STATION power puzzle has become a really complex jig-saw affair, with a new bill introduced into the House, adding to the complications. The measure, presented by Rep. Robert L. Ramsay, like the Johnson bill, would forbid powers higher than 50 kw. and open up the clear-channel allocations. No action on the Johnson bill and the new measure appeared in view at this writing.

The FCC, which a year ago was forced to halt its deliberations and decisions on the clear-channel program, when the Johnson bill was originally brought before the Senate, will not await Congressional action on the new measures and will proceed to announce their clear-channel decisions, which will probably appear during the first weeks of the summer season.

THE INTERNATIONAL HIGH-FREQUENCY Broadcasting Conference in Mexico, called to set up a world shortwave broadcasting plan, was in the cauldron stage during the closing days, with FCC Commissioner George Sterling, alternate chairman of the U. S. delegation, indicating that the U. S. might not sign the agreement because of the comparatively few channels assigned to this country.

According to reports, Russia would have about 660 channel hours, Britain about 438 and this country around 220. The plan of channel hours would provide 8000 divided up into 235 channels in eight bands between 6 and 26 mc., with the size of the country and the number of languages spoken among the factors considered in arriving at the allocations.

A complete report on the final shortwave program is expected to be available during the early summer months.

EVERYONE WAS SHOCKED to hear of the death of Edwin H. Colpitts, known throughout the world for his

Colpitts oscillator circuit, one of the two fundamental oscillator systems, which is used extensively in both transmitting and receiving equipment. Mr. Colpitts, who had retired in 1937 as vice president of *Bell Telephone Labs,* played an essential part in the achievement of transcontinental telephony in 1915 and in the radio transmission of speech across the Atlantic Ocean later in the same year.

His discoveries, recorded in twenty-four patents, won the plaudits of young and old in the classroom and lab, in industry and government. His brilliant concepts, which contributed so much to the welfare of our lives, will never be forgotten.

We mourn the loss of a servant of mankind.

AT LONG LAST, the Citizens' Radio Service has become a full-fledged communications service and has received its official rules and regulations for the 460-470 mc. band. Licenses will be issued generally, beginning June 1, to any citizen of this country 18 years of age or older. The licenses will have a life of five years and will be, in most instances, the only authorization required for operation of the station.

According to the rules, Citizens' Radio is intended for "fixed and mobile service . . . for use for private or personal radio communication, radio-signalling, control of objects or devices by radio," and will probably be employed, in the main, for communication on farms, between house and buildings or workers in remote locations; outlying camps and work crews; industrial plants; construction projects; and the control of devices such as gates and garage-door openers, model airplanes, display signs, etc.

Application forms for the licenses, which will be a simple card, will be available at the FCC field offices and in Washington. . . . . L.W.

ADD A SPEAKER EXTENSION TO YOUR RECEIVER

LLEWELLYN JONES, JR.

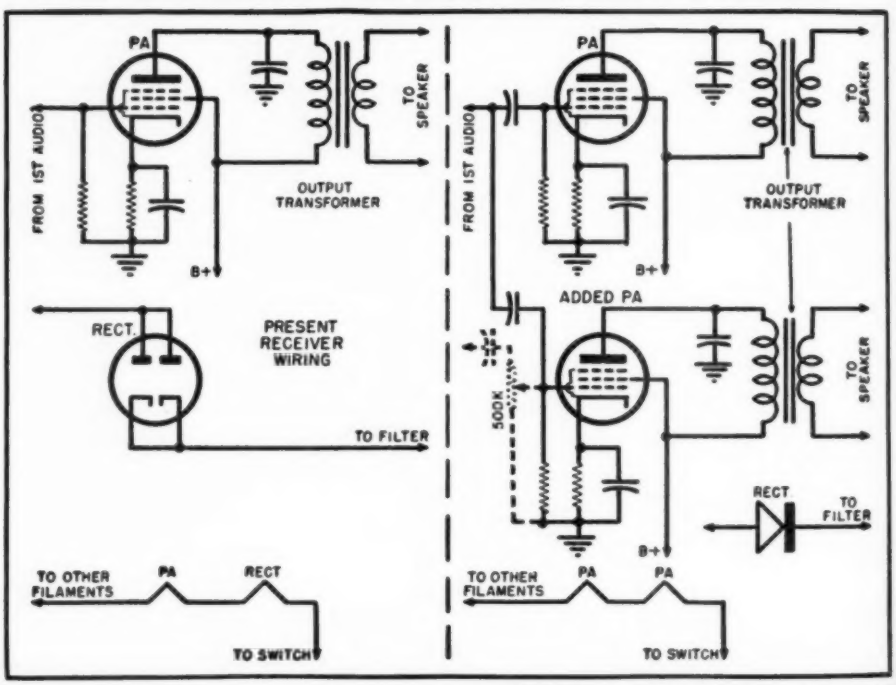
THE conversion of an a.c.-d.c. receiver to accommodate an extension speaker does not pose too big a problem, as it merely entails the installation of a selenium rectifier in place of the vacuum tube rectifier already in place and an additional output stage. The accompanying diagram shows the wiring of the circuit before and after the conversion.

If the usual tube line-up is 35Z5, 35L6, or 25Z6, 25L6, and so on, remove the rectifier tube, and use the socket for an additional 35L6 (25L6) power amplifier stage. By using a PA tube with the same filament voltage and current rating as the rectifier tube, no change will be necessary in the series filament circuit, and the new PA stage can be wired the same as the one already in the set.

The only other components needed will be a grid resistor and condenser, cathode resistor and condenser, and an extension speaker with an output transformer to match the tube installed. If desired, the added grid resistor can be a potentiometer, and this will serve as an auxiliary volume control.

—30—

An extension speaker and an additional output stage can be added to any five-tube a.c.-d.c. receiver without too much difficulty. The rectifier tube can be replaced with a selenium rectifier, and the filament voltage originally allotted to the rectifier tube can be used to heat the filament of an additional output tube. Wiring arrangement before conversion is shown to the left of the dotted line, while to the right is shown complete wiring details of the conversion.



International Short-Wave

(*Continued from page* 108)

alternately with PRB7, '*Radio Tamoio*' on 900 kcs. or PRG3, '*Radio Tupi*' on 1,280 kcs., Rio de Janeiro; all these belong to the group, '*Emissoras Associadas.*'" He reports the *new* Brazilian ZYS8 on 4.955, at Manaus, state of Amazonas (where time is 1 hour *ahead* of *EST*); logged first at 1900 with good level, signed off 1955; again heard later signing off 2130 when said was ending third period of transmission for the day and that would return 0500.

British Guiana—ZFY, 5.985, Georgetown, heard in Newfoundland 1830-1945. (Peddle)

Cameroons — Radio Douala, 9.160, heard in Australia with musical program 1330; signals fair. (Gillett.) Heard in Newfoundland Sundays 1430-1600. (Peddle)

Canada — According to announcement, former VONF and VONH calls have been changed to CBN and CBNX, respectively, following the confederation of Newfoundland with the Dominion of Canada. Now announce "This is the Trans-Canada Network of the Canadian Broadcasting Corporation, stations CBN and CBNX, at St. John's." New QRA is The Canadian Broadcasting Corporation, Newfoundland Division, P. O. Box E-5372, St. John's, Newfoundland, Canada. According to a letter received some months ago, by this time CKRO/X in Winnipeg, Manitoba, should be back on the air; watch for this one on 6.150. (Lyttle, Ontario.) Schedule for CBNX (former VONH) is believed to be 0600-2230 now. (Peddle, Newfoundland)

CBRX, 6.160, Vancouver, British Columbia, heard to sign-off 0302; news 0245-0300; QSL card gives power 150 watts. (Alfred, Ontario)

VE9AI, 9.540, Edmonton, Alberta, news 0000, 0100. (Alcock, Ky.)

Celebes — YDQ, 9.550, new call for this station at Makassar, power 10 kw.; also on YDQ-2, 5.030, 500 watts, and YDQ-3, 11.084, 3 kw.; schedules are YDQ, 1700-1800 (Indonesian), 1800-1900 (Dutch), 2200-0000 (Indonesian), 0000-0130 (Dutch), 0400-1000 (Indonesian); these transmissions are also on YDQ-2; YDQ-3 is used 0500-1000 (Dutch). Forces service is scheduled in Dutch, YDQ-3, 0500-0700; in Indonesian YDQ-2, 0700-0900; news in Dutch 1830 (YDQ), 0015 (YDQ, YDQ-2), 0115 (YDQ, YDQ-2), 0730 (YDQ-3); news in Indonesian 1730 (YDQ, YDQ-2), 1830 (YDQ-2), 2330 (YDQ, YDQ-2), 0900 (YDQ, YDQ-2); news in Makassar 0430 (YDQ, YDQ-2); in Buginese 0440 (YDQ, YDQ-2). (N. Z. *DX Times*)

Heard on approximately 11.086 (listed 11.084) in California, good level, to 1000 sign-off. (Dilg.)

Ceylon — Radio Ceylon, 15.12, has had improved signals here in East lately, mornings.

On April 1, the BBC became responsible for programming for 8½ hours a

day over the s.w. transmitters of *Radio Ceylon*, a station official informed Worris, N. Y. (I note that much of this material is the same as is relayed by the British Far Eastern Broadcasting Service in Singapore—KRB.) The official told Worris: "I am sorry to disappoint you but it is not planned to direct transmissions to North America. The programs will be beamed to China, Japan, Manchuria, Malaya, Burma, and the Far East generally, and to India and Pakistan." The Forces (SEAC) program on Sundays 1130-1330 has ended; this was beamed to the United Kingdom.

Chile — Rosenauer, Calif., has received a letter (in *English*) from Radio Sociedad Nacional de Mineria (National Mining Society), Casilla 2626, Santiago, Chile; confirmed report on CE622; frequencies listed 11.730 and 6.220; no other information given. McPheeters, La., got similar information but lists 25-m. outlet as 11.750 and says has m.w. station on 1060 kcs., and another m.w. outlet (this one at La Serena), CA108, *"Radio La Serena,"* on 1080 kcs., also parallels.

China—A Chinese station heard by Dilg, Calif., on about 9.685, carrying news 0900, may be Canton.

Hankow, approximately 11.495, heard around 1810 in New York State; signal poor with heavy CWQRM and QRN. (Geis.) Heard regularly in Hawaii around 0530-0800, good level. (Fellers)

Recently, the Communist-controlled North Shensi radio was heard giving five frequencies, probably all s.w.; 7.500 is one frequency (old XNCR); approximately 9.049 is another, and a possibility is 6.096; one of these outlets is heard with the 0840 news relay right on top of Cebu, 6.100, Philippines; XRRA, 10.260, Peiping, also now relays North Shensi; all these have news 0840. (Dilg, Calif.) Peiping can be heard with fair signal early mornings here in West Virginia but by 0840 is buried in QRM. Dilg informs me that the Communist-controlled outlets no longer use call letters.

Gillett, Australia, reports a Chinese station heard faintly on approximately 5.018, just at the low side of Makassar which he puts at 5.020 (not 5.030 as generally reported); he hears the Chinese station around 0630 to after 0830, but it is too weak to get call.

BED9 is call of former XURA, Taipei, Formosa; BCB calls are BED2, 750 kcs., BED3, 1020 kcs., BED29, 1020 kcs., and BED22, 670 kcs. (N.Z. *DX Times.*) The 41-m. outlet is now on about 7.215, at least is lower than former listed 7.222, heard in California mornings. (Dilg.) Also heard by Stark, Texas.

A Chinese outlet is widely reported on approximately 11.685, mornings; Dorothy Sanderson, Australia, reports call as BCAF or PCAF (most likely the former), heard 0430 with well-known "March Militaire"; says this station has *English-Chinese* lesson daily at around 0600-0645. I heard this one regularly early mornings here in West Virginia, but it is badly CW-

QRM'd usually. Stark, Texas, says call sounds BGAR or BUAR. Dilg, Calif., says this is definitely BCAF, Taiwan, Formosa, believed to be old XGAF moved from Nanking; XGAF was a Chinese Air Force Station. Signs off 1000, says Dilg. Fellers, Hawaii, airmails me that he hears this one around 0430 to around 0700 with excellent signals, all oriental.

Nanking, 9.732, usually is fair here in East around 0500 to around 0630 (depending when Dominican Republic puts its 9.735 carrier on the air); *no English noted* in this Nanking period.

At the time this was compiled I was hearing Chungking on 7.100 and 15.172 with news 0700; probably will be on Summer Time *(one hour earlier)* by the time you read this. The 11.913 channel recently has been running 0845-1140 or 1150, news 0900, 1100. This one has bad CWQRM in East, but some days is readable in 0900 news period. Direct from the station, I have this message—"We have changed our call signs to BEF6, BEF7, and BEF8 instead of XGOY and XGOX; in order to avoid confusion we always announce either 'The Voice of China in Chungking" or 'This is China Calling from Chungking' for our listeners' identification." I have heard both these given recently. Schedules just received *(may now be one hour earlier if China is on Summer Time)* are listed 15.17, 7.153, to Australia, New Zealand, East Asia, 0455-0635; 15.17, 7.153, 0635-0835, to East Asia, South Seas; 11.913, 7.153, 0845-1100 to North America, Europe; 11.913, 7.153, 1100-1150 to Europe, America, China, South Seas; news 0700, 0900, 1100; at the time this was compiled was being heard on this schedule in America *but* the listed 7.153 still remains actually on 7.100.

Cuba—COCH, 9.445, Havana, heard 2030-2130. (Peddle, Newfoundland)

Czechoslovakia — Prague, 9.55, still has news for North America 1900, in clear to 1910 when Paris carrier usually comes on and blankets Prague. (Boice, Conn.)

Denmark—OZH, 15.165, Copenhagen, is used Saturdays, Tuesdays, Thursdays 0500-0600 for Far East; news just before closedown. (Pearce, England)

Dominican Republic — HI1N, 6.050, Ciudad Trujillo, heard 1745-1900. (Peddle, Newfoundland)

Ecuador—HCJB, Quito, is now issuing schedules quarterly, free on request to HCJB, Casilla 691, Quito, Ecuador. *English* periods are scheduled now Tuesday through Sunday—0630-0730 on 12.455, 9.958; 1700-1800, 2100-2300 on 15.115, 12.455, 9.958; 2300-0030 on 15.115, 12.455, 9.958, 5.995; and to Europe at 1500-1600 on 17.890, 15.-115. Incidentally, chief engineer Clayton Howard informs me: "We are getting a lot of good reports from Europe on our 16-meter transmissions, so are very much encouraged with this new frequency."

Finland—Here may be the answer to the question of some DX-ers as to whether Helsinki has left 9.500; I believe the newer QSL card lists 31-m.

channel as 9.555. Pearce, England, reports he picked up Helsinki recently 0255 on approximately 9.560, says apparently has moved there from 9.500; heard another day 0345 and after 0400 was in parallel on 17.800.

France—Paris noted on 9.675 at 1415 with French news. (Norris, Lebanon)

At the time this was compiled, Paris had (temporarily?) suspended the second daily transmission to North America (beginning at 2100). (Worris, N. Y.)

French Equatorial Africa — Alfred, Ontario, reports Brazzaville on 15.160 (on Sundays at least) to sign-off 1055, program of French music.

The 6.024 channel heard with interval 1830 and at 1833 announced and continued in French, signal only fair. (Ferguson, N. C.)

French Indo-China—Radio Saigon in QSL card via airmail lists *English* sessions on 11.780 daily 1830-1845, 1930-2000, 0415-0530, 0830-0930. (Pearce, England.) A station believed to be *Radio Saigon* is again being heard on about 7.215, mornings; and a station believed to be in French Indo-China is heard mornings on about 6.087, relaying Paris. (Dilg, Calif.)

French Morocco — Radio Maroc, 6.005, heard 0130-0215 fade-out; seems to have French news 0145-0200, Arabic to fade-out. (Alfred, Ontario.) Location is Rabat.

Germany — RIAS, 6.080, Berlin, strong signal in England to 1100; also heard 1800 after "Voice of America" program, and with *RIAS* programs to 1900. *Radio Stuttgart*, 6.030, heard mornings and afternoons, blanketed in QRM after around 1230; news in German 0645, 1145. (Pearce, England)

Hamburg, 7.29, heard weekdays signing on 2300 with good signal; news in German 2345; fades out around 0200; same station logged 1720-1830 with good level, signed off 1900. (Leven, Brazil)

Greece—Mitchell, Perth, lists Athens on 9.607 at 0030-0235 and 0500-0800 daily; 15.345 heard 1000 with news in Greek at dictation speed; at 1040 news in *English*, followed by news in French; heard on 7.300 at 1100 with news in Turkish, followed by news in Russian, then in several Balkan tongues; music and commentaries followed to 1615 when news in Greek was repeated; at 1630 had preview of next day's program and left air 1635 with Greek National Anthem; said at sign-off 15.345 and 7.300 were parallel. *(Radio Australia.)* The 15.345 channel is still heard, with improved level, daily to U. S. at 1730-1830, news (by woman) at start. Schedules received by Hankins, Pa., are—Daily to Northwestern Europe and U. S. A. on 15.345, 7½ kw., 1015-1045 news in Greek; 1045-1100 news in *English;* 1100-1115 news in French; 1730-1830 special program for U. S. A. (news in *English* and in Greek with a musical program in between). Daily on 9.607, 7½ kw., 0030-0235, relay of Greek m.w. program; 0500-0800, also relay of Greek m.w. program. Daily on 7.300, 7½ kw., 1200-1330 news in Turkish, Russian, Rumanian, Serbian, Bulgarian, and Albanian (15 min. for each language). Interval signal is the first few bars of the Greek song, "Kato Ston Valto."

Radio Broadcasting Station of the National Greek Army, Larissa, 6.745, has news in *English* at 1430 then music to 1500; said *English* broadcast would be at same time on Tuesdays, Fridays, and Sundays; on Mondays and Thursdays at 1430-1500 has French; full schedule 0015-0200, 0500-0700, 1100-1500; power 500 watts; asks for reports to Radio Broadcasting Station of the Greek Army Corps, Larissa, Greece. (Pearce, England.) Bouras, Michigan, just returned from a stay in Greece, informs me that the head of *Radio Athens* told him Larissa is operating with less than 1 kw. power and is called The Armed Forces Radio Station, Troop 453, Class B, Army of Greece.

Honduras—HRN, 5.884, Tegucigalpa, heard 2145-2330. (Peddle, Newfoundland)

Hong Kong—ZBW-3, 9.525, heard on occasion in French to 0600 when BBC news was relayed; this apparently is not daily for more recently was heard at that time with recorded music compered in *English*. (Gillett, Australia)

India—Current *(new)* schedules of *All India Radio*, by channels, are—4.840, VUC2 0815-1230; 4.880, VUB2 0900-1230; 4.920, VUM2 0700-1200; 4.960, VUD2 0815-1230; 6.010, VUD8 0945-1315, 2215-2230; 7.210, VUC3 0200-0430, VUC2 0630-0800, VUC3 0815-1230, VUC2 2000-2200; 7.240, VUB3 0215-0400, VUB2 0630-0845, VUB3 0900-1230, VUB2 2100-2300; 7.260, VUM3 0200-0430, 0530-0630, 0700-1200, VUM2 2030-2230; 7.275, VUD10 0745-0815, VUD11 0915-1100; 7.290, VUD2 0630-0800, 2100-2300; 9.530, VUC2 0200-0430, VUC3 0630-0800, 2000-2200; 9.550, VUB2, 0215-0400, VUB3 0630-0845, 2100-2300; 9.590, VUM2 0200-0430, 0530-0630, VUD5 0815-1100, VUD3 1130-1230, VUM3 2030-2230; 9.620, VUD7 1400-1500; 9.660; VUD11 2215-2300; 9.670, VUD9 0340-0350, 0700-1315; 9.680, VUD2 0200-0400, VUD9 2215-2230; 11.760, VUD11 1400-1500; 11.790, VUD11 1130-1230, VUD5 1400-1500, 1845-1900, 2215-2300; 11.830, VUD8 2030-2115, 0215-0350, 0700-0915; 11.850, VUD4 0220-0400, 0730-1230, 2030-2230; 11.870, VUD11 2030-2200; 15.160, VUD7 1000-1045, 2030-2200; 15.170, VUD10 1110-1315, 1400-1500, 1845-1900; 15.190, VUD5 0030-0800, 2030-2200; 15.290, VUD10 0030-0730, VUD3 0830-1100, 2030-2230; 15.350, VUD9 0220-0250, 2030-2115; 17.760, VUD3 0220-0400, 0730-0750; 17.800, VUD7 1110-1315; 17.830, VUD7 0030-0900, VUD10 1000-1045, 2030-2200; 21.510, VUD11 0030-0800. (Legge, N. Y.)

English periods are now scheduled 2030, 17.83, 15.16, 11.87; 2130 (news), 17.83, 15.29, 15.19, 15.16, 11.87, 11.85; 0030, 21.51, 17.83, 15.29, 15.19; 0130, 21.51, 17.83, 15.29, 15.19; 0300 (news), 17.76, 15.29, 11.85, 11.83; 0630, 21.51, 15.19; 0730 (news), 17.76, 11.85, 11.83, 9.67; 1000, 17.83, 15.16; 1030 (news), 17.83, 15.29, 15.16, 11.85, 9.67, 9.59, 7.275,

6.010; 1215, 15.19, 11.79; 1400 (experimental), 15.17, 11.79, 11.76, 9.62.

Indonesia—Dilg, Calif., reports a *Republican Indonesian* outlet on about 7.620, schedule unknown and running until *after* 0930; later he heard this one signing off 0945 with "Good Night Melody."

Radio Solo, 3.300, Central Java, is on daily 0400-0900; Forces Broadcasting Station of the Dutch Strijdkrackten Radio Service, 5.020, Djogjakarta, is heard 0900, also on 5.620. (Cushen, N. Z., via URDXC)

Iran — Teheran, 15.100, normally runs to only 1410 but some days has been heard as late as 1430; news 1340. (Fargo, Ga.) EQC has moved from 9.680 to 9.660.

Iraq—HNA, 7.092, Baghdad, fair to 1400 with Arabic music; news in Arabic 1400 to 1410, then signs off with march. (N. Z. *DX Times)*

Israel — According to Bluman, formerly of Eritrea but now in Tel Aviv, *Kol-Yisrael,* Tel Aviv, 651 kcs. and 6.820, and Haifi, 8.170, are scheduled Mondays to Fridays inclusive 2345-0100; Saturdays 0030-0130; Sundays 2345-0130; daily 0430-0715; Sundays to Fridays inclusive 1000-1530; Saturdays 1000-1600; *English* daily 0700, 1000. *(Radio Australia.)* (Time of last *English* newscast may be in error, as formerly was at 1500; may have been converted incorrectly by *Radio Australia.*

Italy—*"Rome Calling"* heard on 9.63, 6.085 with news 1615 during European session of 1545-1630. Schedules received from Rome list to Europe on 9.630, 6.085, 1545-1630, news 1615; for North America, 11.810, 9.630, *English* 2015-2055, news 2015; for Pacific, 15.120, 11.810, *English* 0520 during transmission of 0500-0530; for South Africa, 1340-1410, 11.810, 9.630, with *English* 1340-1355. (Pearce, England)

Japan—AFRS, 6.015, Tokyo, is usually a fair signal early mornings in East; best around 0600-0700. Occasionally, the station on 15.225 can be heard around 1820; at 1830 announces "N.H.K."

The 7.285 outlet has been good 0400 with *English* lesson. (Alcock, Ky.)

Kashmir—Radio Srinagar is broadcasting on approximately 4.866 in the 61-meter band. *(Radio Australia)*

Korea—HLKA, 7.935, Seoul, heard in England 1600. (Staples)

Lebanon—Printed schedules received airmail from Ned Norris, Beirut, list *Radio-Liban* on 8.036 at 0045-0100 (Sundays 0145-0200), 0630-0730, 1400-1515; news in French 0045 (Sundays 0145), 0630, 1400. I believe *English* is used between 1000 and 1100,

Libya—"This Is Your Forces Broadcasting Service," 4.790, Benghazi, heard from around 1430, often reaches R-7 between 1500-1600 when signs off with Ted Lewis' recording of "Good Night Melody"; at 1545-1600 has a sort of epilogue program—classical music and singing of hymns; speech intelligibility poor due to strong CWQRM. (Pearce, England)

Luxembourg — Radio Luxembourg, 15.350, signs on 0700; news in French 0700; the 6.090 channel heard on Sundays 1130-1300 with *English* program, then French; announced another *English* session for 1700. (Pearce, England)

Madagascar—Radio Tananarive, 12.127, heard 0745-0810, fair level. (Alfred, Ontario.) Fellers, Hawaii, reports the 9.695 outlet heard at 2230, signing on with "La Marseillaise"; then has musical program; news in French 2300; music 2320-0000 at which time station fades out; easily recognized by call "Ici Radio Tananarive."

Malaya—Dilg, Calif., says he hears *Radio Malaya,* Singapore, on 4.780 now mornings; no longer hears the (listed) 4.825 channel, probably has changed frequencies; program is native. Says is good level on 7.200 mornings. Fellers, Hawaii, reports the 7.200 channel at 0630-0830 and later.

Rosenauer, Calif., received a QSL card from the Director of Engineering, Dept. of Broadcasting, *Radio Malaya,* Singapore, confirming his report; listed s.w. outlets at Singapore as 4.825, 6.135, 7.200; Kuala Lumpur as on 6.025.

British Far Eastern Service, Singapore, sent Kary, Pa., these schedules—0415-1130, 6.77, 11.88; 0600-1130, 9.69; 0415-0530, 1030-1130, 15.30.

Mauritius—Laubscher, South Africa, says: "Nothing here on reported Mauritius, although it should be on the air by now." *World Radio Hand-*

book lists Mauritius on 7.143 with 50 watts. *Does anyone hear this one?*

Monaco—Radio Monte Carlo heard 0100-0300, 1300-1715 on 6.035; 0600-0800 on 9.490; m.w. channel now appears 950 kcs. *(Radio Australia.)* Heard on 9.495 in French from 0600. (Pearce, England.) Is listed by station as on 6.035 and 9.490. Hakannson, Sweden, notified Peddle, Newfoundland, that is scheduled 0100-0300 on 6.035, 9.490; 0600-0800 on 9.490 and 11.810; 1230-1715 on 6.035, 9.490. The 25-m. outlet (around 11.810) was recently heard by Milne in N. Z. at 0300. I heard the 6.035 outlet recently, fair level, signing off in French 1715. According to GDX-aren, Sweden, that announces in French, Spanish, and *English;* all I've ever heard has been in French.

Mozambique—Lourenco Marques seems to have settled on approximately 9.750 (seems high as 9.760 at times here in West Virginia—KRB), for *English* periods at 0000-0100 and mornings to 1100 sign-off, excellent signal on West Coast in latter period; the 9.65 channel is heard 0000-0100 in Portuguese, musical program 0000-0015, news in Portuguese 0015-0030, and musical program 0030-0100. (Rosenauer, Calif.)

Beira's CR71B, *"Aero Clube da Beira,"* is back on the air again after some absence; good signal on approximately 7.200 (listed 7.155V); signs off 1500; supposed to have increased power (power listed 300 watts). (Laubscher, South Africa)

New Caledonia—Radio Noumea, 6.000, heard in Hawaii at 0300 and later. (Fellers)

New Zealand—ZL3, 11.78, ZL4, 15.28, now scheduled 1300-0130, 0200-0400, 0430-0620; the 0200-0400 period is beamed for "Australia and the Islands," while other periods are used for relay of Wellington (domestic) outlets. (Legge, N. Y.)

Nicaragua—YNEW, 6.963, Managua, heard 2100-2145. (Peddle, Newfoundland.) A letter from YNXW, *Radio America,* Managua, says it is now on 8.192 from 6.275.5 and using only 100 watts output; uses two 80 output tubes and four 6L6's for modulation; antenna is a "Y" type. (McPheeters, YNOW, 6.850, Managua, heard leaving air 2255.) (Hankins, Pa.)

Norway—Radio Norway heard on a Sunday over 17.825 at 0800-0830 (probably daily schedule); announced as operating in 13-, 16-, 19-, and 25-m. bands (presumably 21.730, 17.825, 15.170, 11.850); *English* announcements 0800, 0815, and 0830 closedown; program is for Norwegians abroad. On a Wednesday heard on 11.85 at 1430 when announced frequencies in use as in 13-, 16-, 19-, and 25-m. bands. (Pearce, England.) The 15.17 channel is excellent in W. Va., afternoons.

At the time this was compiled, the daily period for Norwegians abroad (some *English*) at 2000-2100 was being carried over 15.17, 11.735, 9.610.

Pakistan—Radio Pakistan, 15.27, Dacca, continues to be good level here in East in 0730 news period; news scheduled 2130, 0730, 1030. Fellers, Hawaii, still hears the 2130 news at good level. *Radio Pakistan* at Karachi has ceased using 6.075 and broadcasts now only on m.w. 825 kcs. and 1,460 kcs. (Lampat, India)

Panama—HORT, 6.060, Panama City, heard 2130-2230. (Peddle, Newfoundland.) HOLA, 9.505, Colon, good volume 1830-2000; program and announcements in both Spanish and *English;* QRA is Apartado 44, Colon, Panama. (Bachman, Pa.)

Paraguay—ZPA1, *Radio del Estado,* Asuncion, transmits on 6.275 with 3 kw., daily in Spanish 1000-1200, 1800-2200. ZPA5, *Radio Encarnacion,* now has somewhat irregular schedule, seems to be 0930-1200, 1500-1705 (early sign-off announced due to electricity shortage); frequency is 11.945. (Leven, Brazil)

Philippines—DUH-5, 11.840, Manila, was heard by me recently for the first time in several months, at 0755 with news; time signal 0800 and man identified the outlet as *"The People's Station,* DZFM," which is the new m.w. call, I believe.

DZH-5, 9.690, Manila, heard 1630 in Australia, poor level. (Gillett) DZH-4, 6.000, Manila, heard 0335-0445 when is blocked out by QRM. (Alfred, Ontario.) Some mornings, Manila, 9.64, is fairly good level 0700-0730 when identifies as "DZRH, *Voice of the Philippines."* Ferguson, N. C., reports it announces at 0630 and continues with program of dance music, fair signal.

Portugal—Emissora Nacional, approximately 15.160, Lisbon, heard signing off with Portuguese National Anthem 1430; also heard often from 1600; one day heard at 1515. (Pearce, England.) Heard by Starry, Pa., signing off 1800 with Portuguese National Anthem; also by Ferguson, N. C., announcing *"Emissora Nacional"* at 1100.

Radio Clube Portuguesa, CS2WI, 12.875, Parede, logged 1700 with *English* vocal recordings; signed off 1740 with guitar music (vocal by man in Portuguese); man and woman announcers, plenty of chimes, *no English noted;* one day was still on *after* 1800. (Pearce, England.) Heard in Newfoundland 1900-2000. (Peddle)

Lisbon, 11.027, heard 0100 to 0245 fade-out; seems to be off Sundays. (Bellington, N. Y.)

Portuguese Guinea—CQM-7, 6.993, Bissau, heard in Newfoundland 1630-1800. (Peddle)

Portuguese India—Radio Goa is again operating on 7.230 at 0900-1030; 9.610 was used for only a short time. *(Radio Australia)*

Rumania—Under exceptional conditions, (through heavy CWQRM, *Radio Bucharest,* 9.252, can be heard 1600 with news; signs off 1630 with choral music.

The 6.210 outlet has *English* 1500-1530. *(Short-Wave Review,* London.) *(This also may be at 1600 now.*—KRB)

Siam—Bangkok announces as "49.7 and 30.62 meters"; has news 0615; some days at least takes program in

Indonesian-Malay *after* 0630; frequencies at the time this was compiled were 6.010, 9.798. (N. Z. *DX Times.*) Both these channels are heard on occasion in the U. S.; I note on 6.010 that some days the 0615 news is by a woman, other days by a man; the 9.798 channel has severe CWQRM. The transmission for overseas listeners begins 0500, runs to at least 0630 and some days seems to continue to almost 0700. The native program is heard by Balbi on West Coast around 0700-1007; uses 9.798 for this—and either 6.010 or 6.240.

The 9.798 outlet heard in Ontario at 0530-0630, good signal; CWQRM very heavy after 0600; news in native by woman 0545-0700; uses trumpet on half-hour. (Alfred.) Around 0630 when identifies I note (on 6.010 which is best outlet here in West Virginia) the station uses NBC-like chimes. Best day for East is Sunday when there is less QRM on this band early mornings. Balbi, Calif., says Bangkok's interval signal is 6 chimes.

South Africa—Weisberg, N. Y., has just received *new* schedules from SABC; in part, they are Johannesburg, 4.800, weekdays 2345-0130, 1120-1605; Sundays 2455-0130, 1100-1605; 9.870 weekdays 0315-0710, 0900-1110, Sundays 0315-1050; 4.373 carries all sessions. Cape Town, 5.880 or 9.610 at 1320-1500. These are for *English* periods and are *not* complete schedules.

Spain—Verie from *Radio Mediterraneo Valencia* gives schedule on 7.037 as 0700-1000, 1400-1800; station opens with march "Hacia Valencia," closes with "Marcha de la Ciudad." (Gillett, Australia)

Sumatra—According to verie, *Radio Palembang* is on the air daily 0430-1000 on 4.855 with programs in Dutch and Indonesian; QRA is *Radio Palembang,* Kantoorin Studio, Talang Djawa 7, Palembang, Sumatra. (Gillett, Australia)

Surinam—PZH5, 5.758, Paramaribo, heard 1745-2030. (Peddle, New foundland)

Switzerland—Berne is no longer using 11.815, 15.320, 21.520. *New* schedules are HER3, 6.165, to Europe 0020-0140, 0500-0830, 1030-1700 (Sunday 0245-1700.) HER4, 9.535, to Europe 0020-0140, 0500-0830, 1030-1700 (Sunday 0245-1700); to South America, 1830-2000; to North America, 2030-2300. HEU3, 9.665, to Great Britain and Ireland 1345-1530. HEI5, 11.715, to Australia and New Zealand 0215-0445. HER5, 11.865, to Australia and New Zealand 0215-0445; to India 0945-1130; to Near East 1145-1330; to Great Britain and Ireland 1345-1530; to Spain and Portugal 1545-1715; to North America 1730-1815; to South America 1830-2000; to North America 2030-2300. HED7, 15.120, to Far East 0745-0830; to Near East 1145-1330; to Spain and Portugal 1545-1715. HER6, 15.305, to Africa 0020-0140; to Far East 0215-0445, 0745-0930; to Africa 1030-1700; to North America 1730-1815; to South America 1830-2000; to North America 2030-2300. HER7, 17.784, to Africa 0500-0730; to Far East 0745-0930; to

India 0945-1130; to North America 1730-1815. (Legge, N. Y.)

United Nations Radio, 6.672, Geneva, still has news daily except Sunday 1330. *(ISWC)*

Syria—Damascus has replaced 7.500 with 7.275. (Swedish DX.) The 12.000, 7.275, 6.000, and m.w. 592 kcs. and 752 kcs. are scheduled now daily 0730-0800 in *English* and 0800-0830 in French. *(Radio Australia.)* (This is probably not complete schedule.—KRB) The station informed Rugtvedt, Norway, it transmits 0000-0100 Arabic; 0645-0730 Arabic; 0730-0830 *English* and French; 1100-1545 Arabic. Milne, N. Z. reports the 6.000 outlet heard 0630 in Arabic.

Tangiers—Radio International, now on 6.110 from 6.115, heard from 1730 recently; call given in Spanish by man, in French by woman; still going 1915 with Spanish; during weekdays is heard at 1430 in Arabic. (Pearce, England)

Turkey—TAP, 9.465, Ankara, heard in England with *English* 1445.

Uruguay—CXA-19, 11.835, Montevideo, gives special news bulletin in Spanish for overseas listeners 1700-1730; announcements made in Spanish, French, and *English.* (Swedish DX)

U. S. A.—Latest AFRS schedules of East Coast transmitters include 1415-1745, WNRX, 11.89, to Europe, N. Germany, Norway, Sweden; 1400-1745, WRCA, 15.15, to C. Europe, France, Germany, Poland; 1400-1745, WBOS, 15.21, to Mediterranean, N. Africa, Turkey, Palestine, and 1400-1745, WGEX, 17.88, to S. Europe, Spain, Austria, Italy, Balkans. (Worris, N. Y.)

U. S. S. R.—Moscow begins a one-hour broadcast to India and other parts of Asia at 0700 on announced 15.340, 9.690, 6.180; latter can't be heard in Australia, other two heard well. (Gillett.) The 15.340 channel is good level here in West Virginia during this 0700-0800 *(English)* period.

Norris, Beirut, Lebanon, reports he recently logged Moscow on 15.212 (measured) with good signal at 1000-1030 in a Slavic tongue.

A Soviet station is being heard on approximately 10.50, strong, at 0515-0630, Chinese at 0600, parallel with 11.750. (Balbi, Calif.)

Radio Moscow presents a short Mailbag Program (no names mentioned) on Saturdays around 1908 on 15.23, 11.88, 11.72, 7.36, 7.29; 11.72 best. (Boice, Conn.)

Venezuela—Verie letter in Spanish from "La Voz de Carabobo," Valencia, gives new call on 4.780 as YVLA and on 1,350 kcs. as YVLB (formerly YV4RA and YV4RO, respectively). (McPheeters, La.)

Unidentified—A station has been heard on approximately 17.800 (just below 17.810 BBC), fading in 1115, sounds like AIR, still going 1210 but with BBC interfering. (Stark, Texas.) This is likely VUD7, 17.800, now scheduled 1110-1315.

Bellington, N. Y., reports a station on about 8.82 testing at 2135 tune-in, fair signal but was right atop a Cuban station listed COCQ; played popular American recordings and other songs including some Spanish numbers; announced song titles in *English;* at 2140, with no announcement whatsoever, station disappeared. He also reports a station on about 9.54 testing 2330 sign-on; tremendous signal but had transmitter trouble and bad needle scratch from recordings; was in clear; signed off 0010; no announcements made. I wonder if this could have been ZL2, 9.54, Wellington, New Zealand, testing?

During the spring I have been hearing a very faint station mornings on 11.850 (not Delhi!) which I'm wondering if possibly might be former XORA, Shanghai. (*Any data as to Shanghai's whereabouts on s.w. and current schedule would be welcomed.*—KRB)

* * *

Last Minute Tips

Has the high-powered projected station at Fernando Po, off the West Coast of Africa, been heard testing yet? *(I would appreciate any information on this one if it is heard.—KRB)* The *Radio Atlantico* reported by NNRC some time ago as heard testing may have been *Radio Atlantis,* Tangiers, on 14.420.

A station heard by Dilg, Calif., on approximately 7.520, signing off 1000 with Dutch National Anthem may be Bandoeng or some other Indonesian; plays a lot of old American popular recordings, Dilg says.

SABC recently notified Laubscher, South Africa, that they still *do not* have call signs.

Pearce, England, observes that special broadcasts for overseas listeners at 1400-1500 from AIR, Delhi, are radiated on (announced) 15.17, 11.85, 11.76, 9.63; but says, however, that the 25-m. channels appear to be actually 11.76 and 11.79 (*not* 11.85).

Shortly before this was compiled, I received a flash from Anson Boice, Connecticut, that he was hearing a good signal daily from ZUD, Victoria, South Africa, testing on 17.748; said carrier comes on around 1300; occasional spot announcements to 1400, then may present SABC program or recordings; were calling BBC one day at 1425; said signs off daily 1430. A later flash on this from Boice says is still testing daily except Sunday on 17.748 at 1400-1430, R-9 signal.

For several months the Deccan Hyderabad station has been operating *only* on 730 kcs. m.w. *(Radio Australia)*

A *new* station reported by Indian correspondents to *Radio Australia* is at Jodhpur in Rajputana; announces as operating on 80 meters and is scheduled 0800-0930 except Sunday when is on the air 0800-1000; there are no regular *English* language programs but talks in that language are given on occasions; signs off with well-known Bengali National Anthem.

Gaynor, Calif., says he gets a strong station from Tiajuna, Baja California (Lower California, in Mexico) around

49 evenings; generally catches this one around 2000; says Spanish is too fast to get call letters.

All India Radio, 11.79, is putting in an average R8 signal in Connecticut 1845-1900. (Boice.) Also reported by Fuller, R. I., and Ferguson, N. C. Listed officially as in Indonesian, as experimental, and as on 15.17, 11.79.

DX-Radio, Sveriges Radioklubb, Sweden, reports Shanghai as on 11.870. (*Can anyone confirm?*—KRB)

A NNRC member has received a letter from Major Leslie Knight, Chief Broadcasting Officer, HQ Forces Broadcasting Service, MELF, Malta Garrison, which in part reads—"The latest news on the Forces Broadcasting Service, MELF, is that we are endeavoring to install three *RCA* ET-4750 transmitters in Malta, but owing to lack of technicians the progress is extremely slow. However, when the installation is complete, we shall endeavor to beam our transmissions so as to cover the whole of the Eastern Mediterranean. We anticipate to be transmitting by the end of March. We are now in the process of obtaining the necessary frequencies and as soon as these are finalized, I will give you full details." It was stated that Mombasa in East Africa is operating with a BC-610 transmitter, 250 watts, on 7.220; other stations in the network include m.w. outlets in Tripoli, Benghazi, Kabrit, and Cyprus. Benghazi was listed on 6.130 s.w. with 250 watts. Major Knight said: "These stations will continue to operate when the main transmitters at Malta are working but will relay transmissions of the main service."

Tips received at press time from Balbi, Calif., include—BEA8, 9.73, Nanking, now signs off around 1010 or 1015, excellent signal; JBD3, 15.225, Tokyo, has replaced JBD, 9.505, from 0300 on. *Radio Ceylon,* 15.12 and 17.73 now sign off 1200 instead of former 1130. Paris, 21.74, heard irregularly around 1030-1100 in French only. OIX4, 15.19, Helsinki, again heard with fine level 2200-2400, not on 17.78 any longer. DUZ5, 11.84, Manila, heard with good signal from 0400 on. XRRA, 10.26, Peiping, heard to 1030 irregularly.

ZRB, SAAF station, Pretoria, South Africa, at last is using 6.210 in parallel with 9.110. (Laubscher, South Africa)

XEQQ, 9.680, Mexico City, now seems to have an *English-compered* program on Saturdays 2230 or 2245 to 2315 or 2330; asks for reports to P.O. Box 940, Mexico City; program is called "South of the Border" and features hit tunes of the week from U.S.A. and Mexico. (Hankins, Pa.)

Late tips received airmail from Lampat, India, include—*Radio Kashmir* is transmitting on approximately 61.79 meters, leaves the air 1100; *Radio Goa* now operates on 7.230 at 0900-1030, closing with Portuguese National Anthem, broadcasts in Portuguese, Konkani, Urdu, Marathi, and Gujarati, is 500 watts. *Deccan Radio* in Hyderabad is *not* broadcasting on s.w. 6.170 and 3.335 any longer; only on 411 meters with 5 kw.; in case this one returns to the air on s.w., it probably will be scheduled with the m.w. transmitter (which features *English* news 2210, 1000, and ends transmission at 1230).

Finally, these tips from Dorothy Sanderson, Australia, are offered—XGYA, 7.990, heard 0535 with Chinese news relay from XNCR; BCAF heard on 8.990 at 0545 with Western music, then in Chinese, and with *English* lesson on Wednesdays 0610-0645; DZH5, 9.69, Manila, heard 0515 with musical program and frequency details; DZRH, 9.64, heard 0530; DUH5, 11.84, heard 0515 with sponsored program of music and news; DZH4, 6.000, heard 0545 with sponsored program; Saigon, 7.21, heard 0605 with news in French; Shiras, Fars, Iran, heard on 7.96 at 1545, bugle call and time pips, with Persian program *(not on daily);* SUX, 7.86, Cairo, heard 1530 with usual Arabic-type program of music and news; Johannesburg, 4.89, heard 1545, good signal; CR7BU, 4.91, Lourenco Marques, Mozambique, excellent in Australia 1530 in Portuguese.

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Acknowledgement

Many thanks for all reports; keep them coming to 948 Stewartstown Road, Morgantown, West Virginia, U.S.A. . . . . K.R.B.

Mac's Service Shop

(*Continued from page* 60)

"Is there any good way to test or compare boosters?"

"One way is to run a signal from a signal generator into the booster with a 300-ohm resistor across its output. The r.f. probe of the VTVM can be used to measure the input and output voltages and so arrive at the gain. By shifting the frequency of the signal generator and plotting the consequent changes in output voltages, you can get a rough idea of the bandwidth. A better way to do this is to put in a signal from a TV sweep generator with about a ten-megacycle sweep and to pick off this amplified signal from across the 300-ohm load resistor with a crystal diode probe feeding into your 'scope. That way the response curve can actually be seen, and you can use marker pips to tell exactly at which frequency it peaks, dips, etc."

"Why is it that the same booster wants to oscillate on some receivers and not on others?"

"Very probably it is the antenna that makes the difference. The input circuit of the booster is designed to be loaded with the 300-ohm load of the lead-in. If the lead-in has standing waves on it, the impedance at the booster may be much higher and afford little or no loading, and the booster will want to oscillate. Incidentally, when a booster is on the edge of oscillation, its normal bandwidth is considerably narrowed, for regeneration sharpens up the response."

"Hey, Boss," Barney said suddenly, "see if you can explain this one: The other night I was visiting a guy who owned a TV set, and the joker had three boosters lined up on the floor in front of the receiver. He had the dial reading *and the position* of each booster written down on a card for every live channel, and he followed this to the letter. For example, when he went from channel 5 to channel 4, he swung the booster nearest the set forty-five degrees out of line with the other two; and the picture was twice as good as it was when the booster was moved back into line."

"That sounds wacky," Mac chuckled, "but I think I understand it. Moving the booster changed the coupling, and hence the regeneration, between it and the other units. This change in regeneration increased the gain when the booster was in the critical position and so improved the picture."

"What do you think of cascaded boosters? Isn't one enough?"

"All I know is what I have seen, and I know cases where two or even three boosters got a picture when one could not do it. The effect is apparently the same as you get with stagger-tuning in the i.f. stages. The over-all gain is not much greater than that of a single sharply-tuned unit, but the response curve of the group is much better—hey!" Mac broke off, "aren't you listening?"

"Sure," Barney told him, "but I was just wondering if I couldn't borrow a balloon off of one of those bubble-dancers down at the *Bijou*!" -30-

CHECKING AUTO TYPE VIBRATORS FOR CONTACT BOUNCE

By ALLAN S. JOFFE, W3KBM

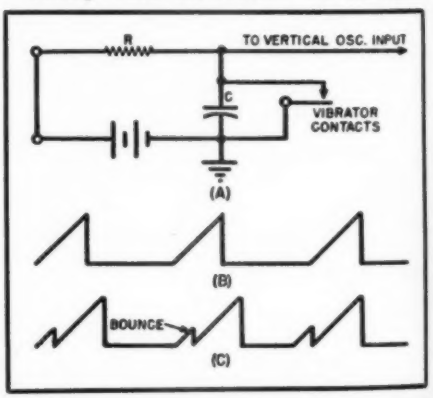
IT IS often interesting to check a vibrator when faulty operation is indicated to see if contact bounce is present. According to some, this condition can lead to low output, eventual sticking or welding of contacts due to excessive heat and wear, and a certain amount of hash due to excessive sparking.

When checking this condition with a cathode-ray oscilloscope, the suggested methods lead to confusing patterns not easy to interpret. With this in mind, the following method was developed.

The circuit shown represents a resistor of approximately .5 megohms and a condenser, plus a series battery of about 45 volts. This series combination is shunted across the pair of contacts under investigation. The alternate shunting and opening of the vibrating contacts results in a saw-tooth across the condenser. This voltage is then applied to the vertical input of an oscilloscope which will display the pattern in Fig. 1B if no bounce is present. If bounce is present, however, the pattern of Fig. 1C will be developed, the small saw-tooth being the result of the contact bounce. Its amplitude is smaller than that of the main saw-tooth because of the smaller charge time allowed the condenser.

The condenser may have a value of from .1 to .5 μfd. The relative amplitudes of the large and the small saw-tooth is an approximate measure of the degree of contact bounce present. This method also makes it very easy to determine if the particular vibrator will give proper operation when mounted off the vertical. -30-

Fig. 1. Circuit arrangement for checking vibrator, along with oscilloscope pattern with and without bounce effect. The function of the series resistor is that of limiting the current from the battery when the contacts are closed.



Signal Marker

(*Continued from page 55*)

visable to change the capacitance to some lower maximum value, such as 15 or 20 $\mu\mu$fd. At considerably higher frequencies, when lower-capacitance tuning units are used, the frequency spread will be reduced, due to the lower ratio of minimum-to-maximum capacitance in the tuning condenser. At considerably lower frequencies, it will be necessary to change tuning condenser C_1 to a higher maximum capacitance unit, say 250 to 500 $\mu\mu$fd. The values of inductance required to cover a specified frequency range with a given tuning condenser may be found from any of the *reactance charts* appearing in the various radio handbooks.

Additional Applications

Because they are interested in maximum utility, servicemen and experimenters, after reading the functions of an instrument, usually want to know what else the device will do. With this in mind, we list below several additional functions which will be performed by the signal marker.

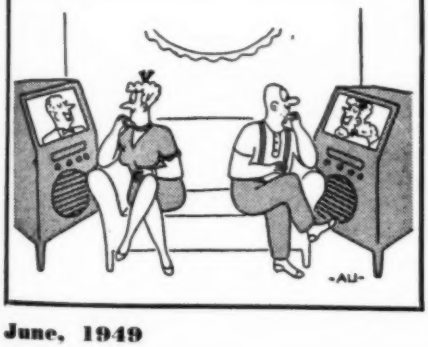
1. *Wavetrap and interference eliminator.* Connected between antenna and receiver, the marker acts as a conventional wavetrap and as such may be used to remove or reduce an interfering signal, or to identify the frequency of such a signal.

2. *Frequency spotter.* Connected between an uncalibrated, modulated oscillator and a simple monitor (such as crystal detector and headphones), the marker serves as a rough frequency checker within its tuning range. To operate, tune the marker to eliminate (or reduce) the signal in the monitor, and read the unknown frequency from the marker dial.

3. *Filter.* The marker will serve as a simple narrow-band-elimination filter when connected in series with two stages or between two suitable circuit points. Its use in this manner is somewhat limited, however, since the marker circuit does not offer large attenuation to strong signals.

4. *Harmonic eliminator.* When connected between stages or between two suitable circuit points, the signal marker will serve to remove or reduce troublesome harmonics which lie within its tuning range.

-30-



Beginning Amateur

(*Continued from page* 59)

straight forward in this c.w. transmitter, it worked fine on its fundamental frequency.

A factory-made unit is recommended for the plug-in tuning coil, L_1. The one specified is neat and cheap, and of a type efficiently constructed that cannot be duplicated easily with ordinary home-shop facilities. In addition to the 40-meter coil listed, there are interchangeable coils for 10, 20 and 80-meter operation, making the transmitter very flexible.

A meter to measure the plate current of V_1 is very important, as this current indicates the condition of the tuning circuit. It costs a couple of dollars, but it is a very smart investment because it can be used with any transmitter you build, and you can be sure that you'll be rebuilding all the time! Flashlight lamps are often recommended as current indicators in "beginner" transmitters, but in my opinion they are not satisfactory. Mount the meter in a small box, fitting it with binding posts and a length of flexible lamp cord for leads, and connect it to the two right hand terminals on the back of the chassis. If it reads backwards the first time you turn on the transmitter, merely reverse the leads.

Generating radio-frequency power by means of modern vacuum tubes is a relatively easy process. The real trick in all short-wave transmitting work is to feed this power to an antenna and to make the latter squirt off some of it into space in the form of radio waves. Antenna theory is very complicated and, in some respects, not very clear, but the practical operation of certain forms of "sky wires" is pretty well understood. The folded dipole antenna makes a good start for the beginner because it is reliable. Use it to get on the air, and do your experimenting with the more complicated styles later on.

The antenna length bears a definite relationship to the operating frequency as determined by the crystal. Several factors for figuring the length of twin lead have been used with success. To get the length in feet, divide 459 by the frequency in megacycles. For our 7.15 megacycle crystal, this comes out to 64 feet, 3 inches. Add three inches for tying purposes, and buy a hunk of twin lead 64½ feet over-all. You'll need another piece for the lead-in or transmission line, and its length will be determined by your location. The idea is to hang the antenna itself as high and as clear as possible, and to let the transmission line take care of itself. It can be as long as 100 feet.

You'll need a helper to stretch out the wire on the sidewalk. Measure off 64 feet, 3 inches carefully, using chalk marks, and spot the center position, also carefully. Trim the insula-

tion 1½ inches off of the two wires at one end only of the double wire; push these through one eye of an aerial insulator, twist them on each other, and solder well. Now, before you do the same at the other end, slip the latter through the two supporting holes of the dipole connector block. This is a 1½ inch square of insulating material, designed to facilitate the connection of the transmission line to the flattop antenna section. Pull the antenna out to length, bare the second end, thread the wires through the second insulator, and check the antenna against the chalk marks before soldering.

Slide the connector block to the *exact* center of the antenna. Cut either wire of the pair, trim back the insulation about ¾ inch to each side, and bare the two ends thus formed. Bring one end of the transmission line (which is also the twin lead stuff) up through the bottom hole and the clamping strip of the block, bare its two ends, and join them to the antenna wires under the binding screws in the block. You are now ready to hang the antenna in the spot you have selected, using any strong wire in the other ends of the insulators to tie to trees, poles, chimneys, pipes, etc. Bring the free end of the transmission line into your radio "shack," fastening it where necessary with small stand-off insulators, to prevent swaying. The line connects directly to the two lugs on the L_1 coil socket marked C and D in the diagram. Don't solder it in place just yet.

Tuning up the transmitter itself is simple, since there's only one knob to turn. Plug in the lamp cord, seat the tubes, crystal, and coil firmly in their sockets, connect the key and the meter and turn on the switch, S_1. Give the tubes 15 or 20 seconds to warm up. Regardless of the position of C_4, close the key for a second and observe the meter. It will probably jump to a reading of 75 or 85 milliamperes. Close the key again, but this time, turn the knob of C_4 quickly. As you pass through a certain position, the current will fall to a minimum of about 25 or 30 milliamps and then rise again. Find a setting of C_4 that gives a minimum of about this value as you key the circuit rapidly. Turn on your receiver, and you'll hear a thumping signal, due to direct radiation from the coil L_1.

Warning: Don't touch anything on the transmitter except the C_4 knob. The coil L_1 carries the full plate voltage (about 350-400 volts) and is hot.

Turn off S_1.

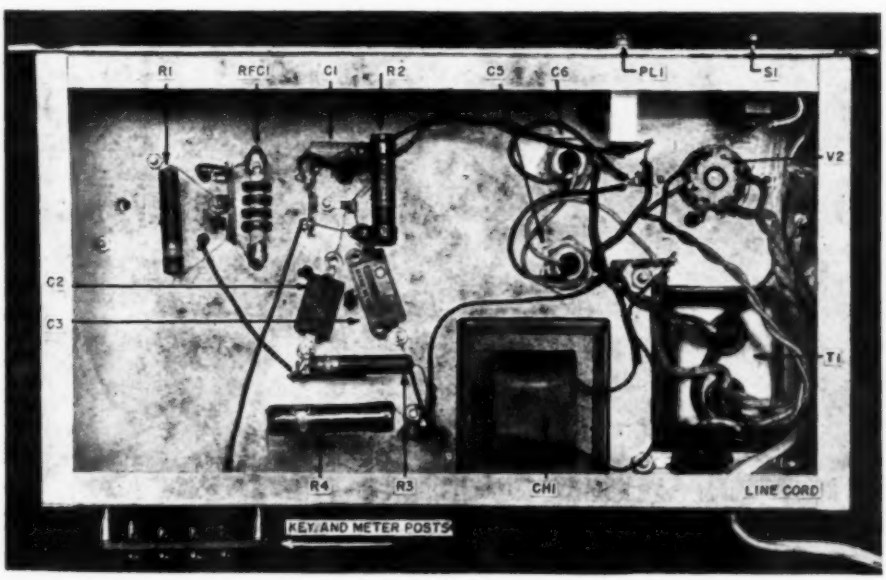
The coil L_1, as manufactured, consists of two windings: a large one of 22 turns, connected to the plate circuit of the tube, and a small one of three turns, connected to the antenna through the transmission line. This antenna coil is a little too small to couple properly to lines of the 300-ohm type. Unsolder the inner end of the winding and add two more turns to it. Use common solid push back wire, and hold it down with little strips of *Scotch* tape.

Now solder the transmission line to points C and D on the L_1 socket, turn on S_1, wait a few seconds, and press the key. The meter will show a higher reading, maybe up to 100 milliamps. Retune C_4 a little, and you'll find that the meter dips again, but this time the "low" is about 80 milliamps. The new dip represents the load of the antenna, and means that the latter is accepting power from the transmitter. If you don't obtain a definite new dip of approximately this value, you may have to add or remove a turn from the antenna coil. Just remember to shut off the transmitter before grabbing it! With a little cutting and trying, you'll hit the right number of turns without too much trouble.

You're now on the air! Send a *CQ*, or call someone who has just sent one himself. When you hear your own call letters coming back at you, you'll know that you have made your first contact.

(To be continued)

Bottom view of the completed transmitter. The wiring is open and readily accessible.



Phone-C.W. Transmitter

(*Continued from page 64*)

works very well without it, even under the regulation effects present in the PE 103 output circuit due to varying loads. The second item is the 6U5 tube shown at the top of the diagram (modulator) and which functions as a V. I. when talking into the microphone. While these tubes are normally used on circuits having relatively slowly changing voltage, such as a. v. c. circuits, it has been found that they respond rather accurately to voice frequencies and peaks hence one has been adapted for use with the present modulator. The tube requires between two and three signal volts for good operation and functions perfectly at the point in the circuit indicated in the drawing.

The half megohm potentiometer R_1, Fig. 5, permits setting the eye so that it just closes, on a steady tone, for 100% modulation. Being an electron operated device the shadow has no lag and will be found of great value in keeping a fully modulated, non-splattering signal on the air.

Values of impedance used on the *UTC* S-20 modulation transformer T_3 are shown on the diagram. While the 4000 ohms primary impedance turns out to be right for the present (and probably other set-ups) the secondary impedance will, of course, vary with the plate voltage and plate milliamperes used by other constructors. The connection sheet accompanying the transformer will show how to obtain other wanted ratios.

In Fig. 1 the modulator controls are, (from left to right) top row; 6U5 volume indicator eye, and the 0-50 milliampere *Weston* Model 506 milliammeter with pilot light immediately below it. The lower row (left to right), shows the high impedance or crystal microphone jack, low impedance or carbon microphone jack, "High-Low" impedance switch, (low impedance—second jack when in "down" position), modulation volume control, "Off-On" switch, output power (to transmitter) plug, and input plug (from PE 103 or a. c. power pack).

For rough usage the author prefers a rugged carbon microphone and has a surplus SW 109 unit as used by the Signal Corps. This has been modified by the installation of a surplus F1 unit. This is a single button carbon unit which is used in telephone work and equipment and which has, besides excellent quality, an output of approximately 1 volt when used in the "close talking" position. With this type carbon microphone in the second jack the rig is modulated 100% with the gain control at midpoint.

For different plate voltages it is advisable to experiment with various bias voltages applied to the grids of the final 815 in the modulator. For different plate voltages bias voltages of from 12 to 22½ volts have been used. The criterion is the quality as determined by listening to a good monitor or receiver.

Power Supply

The power supply used for this rig is a PE 103 genemotor from the surplus market. These may be obtained for under ten dollars in the original overseas packing. They are exceptionally well built and sturdy and, although rated at 160 milliamperes at 500 volts, they are capable of much greater outputs—especially for intermittent service. Fig. 8 gives a set of performance curves for this type device. The curves are self-explanatory. The operating point on the author's set-up is indicated approximately by the 300 milliampere point on the load curve. In addition these genemotors were designed for short-wave work and have an excellent set of built-in filters so that no external filtering is necessary to achieve a steady, hum-free output voltage.

Several minor changes were made by the author. They were, first, to put a jumper across the resistance labeled 3R2 in the dynamotor base. Immediately above the circuit breakers in the case of the genemotor will be found two flat, rectangular resistors lying one on top of the other. 3R2 is the bottom one and strapping it out takes some resistance out of the 6 volt line from the battery, through the genemotor, to the transmitter. Next, the circuit breaker 3E5 in the 6 volt circuit is strapped out which takes all the remaining resistance out of the 6 volt line. Then, the winding of the circuit breaker 3E3 is bridged with a 10 ohm, 10 watt resistor. Since the original winding resistance was 10 ohms this has the effect of making the breaker trip at between 325 and 350 milliamperes instead of just over 160 milliamperes as originally used. Finally, since the author uses the rig on 6 volts only while portable or mobile, the 12 volt brushes (in the longer end bell casing) were removed to get away from commutator drag. While the genemotor was out of the case the lead going to pin #7 on the output plug was unsoldered since the #7 lead in the connecting cable will be used to carry current from the small 7½ volt battery used in conjunction with an a. c. power pack (for keying) when on c. w.

Extra connecting cables for the PE 103, complete with 8 pin plugs, are available on the surplus market and four of them should be obtained. One will be used between the PE 103 and the modulator unit, another between the modulator and the transmitter. The female plug is removed from the third one and mounted on the front panel of the transmitter for power input. The other (male) plug is also removed and mounted on the front panel of the modulator for power input to that unit. The male plug from the fourth cable is mounted alongside this last plug for a connecting cable be-

tween modulator and transmitter units.

General

Since a rig of this type can be used in the shack, on the road, or at camp on hunting and fishing trips—and on all bands—power is one of the prime requisites for securing results from locations whose topography was not designed for radio transmission and reception. For this reason no circuit short-cuts or tricky construction were used. Rather, every advantage was taken of resonant circuit voltages and other features found in the largest transmitters, thus making for efficiency and for maximum possible output from the transmitter.

The rig has been used on all bands with uniformly good results, especially on 20 meters, since the home shack has a 20 meter beam. The Hawaiian Islands and similar distances are consistent DX while the last entry in the log shows a 5 and 9 signal on phone to KG6CQ on Guam in the Marianas Islands. In short the rig has lived up to every expectation and it is hoped that other builders may equal, if not exceed, these results. —30—

RENEWING APPEARANCE OF WRINKLE FINISHED EQUIPMENT

ONE common fault of equipment housed in wrinkle finished cabinets is the dull appearance of such apparatus when dusty. Wiping with a dust rag does not remove all of the dust because of the nature of the wrinkle finish. Blowing with an air jet improves the appearance somewhat but does not remove the dullness.

A sure method of restoring the rich brilliant lustre of the original wrinkle finish is to go over it with a rag saturated with a mixture of carbon tetrachloride and light machine oil. Ten per-cent sewing machine oil and ninety per-cent carbon tetrachloride will prove excellent. The solvent quickly evaporates, leaving a thin film of oil on the finish. Periodic maintenance of this type will keep the appearance of the finish like new . . . . . H.Z.

Clint De Soto Passes Away

Clinton B. De Soto, W1CBD, age 37, editor of "QST" for many years and more recently technical editor of "IRE," suffered a fatal heart attack on the night of April 27, 1949. Clinton De Soto was born in Ogilvie, Minnesota, and held an amateur license since 1926.

A leading figure in amateur radio, scholar, gentleman and capable administrator, "Clint" has left behind a host of grieving friends. He combined literary skill, unusual ability to bring out the best in his associates, and an unfailing devotion to his job. The IRE has lost one of its most capable representatives, and amateur radio, one of its most ardent supporters. The editors of "Radio & Television News" deeply regret the sudden passing of one of their most cherished friends.

Reproducer System

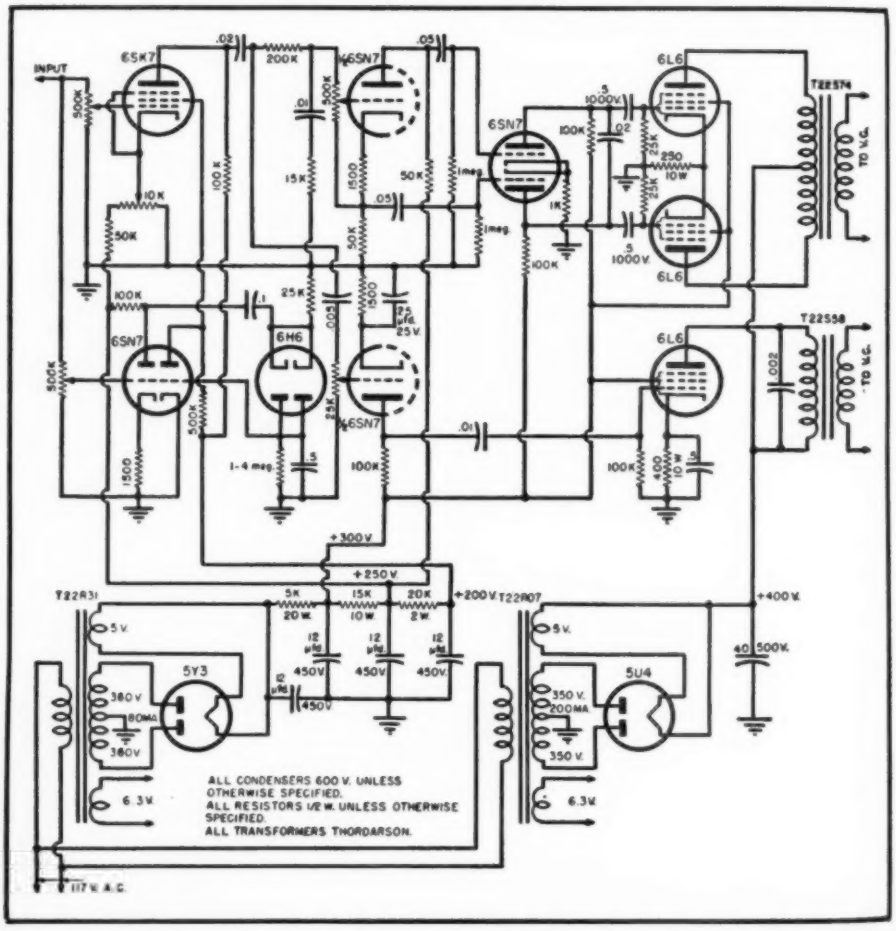
(*Continued from page 45*)

expander are shown in Fig. 1. The principal elements determining the time constants of the circuit are the load resistor and bypass condensor of the 6H6. Increasing the size of these components will increase the delay and decreasing the values will decrease the delay. A two-megohm potentiometer might be substituted for the fixed load resistor to make a convenient means of adjusting the time delay to various types of music. It will be noticed that the cathodes of the 6SK7 and the 6SN7 are fed from "B+" through a voltage divider. This is necessary to provide good grid bias regulation. The optimum grid bias for the 6SK7 appears to be about 15 volts, while the screen grid voltage will vary from twenty to two hundred volts depending on the degree of expansion or compression.

In operation of the expander, the expander voltage control is turned down and the bias of the 6SK7 adjusted until no signal is heard. The expander voltage control is then advanced until only the loud passages come through the amplifier. The compressor operation is quite similar. With the compression control off, adjust the bias on the 6SN7 until the volume decreases slightly, then advance the compression control until the loud passages are reduced to inaudibility. A certain amount of delay in either system may be introduced by increasing the bias voltage. In both the compressor and expander, care should be taken that the input signal to the grid of the 6SK7 does not exceed one volt, or disagreeable distortion may result.

Fig. 2 shows the circuit for an interesting form of frequency discrimination when used in connection with an expander or compressor. The circuit allows the expander or compressor to operate when one range of frequencies alone is predominate. High and low frequencies are fed through suitable filter networks to the two halves of a 6H6. As the output polarities of the two diode sections are reversed, when both highs and lows are present, the net output voltage is zero. When the desired frequency range is present alone, an appropriate voltage is developed which operates the expander or compressor. It should be pointed out that the high frequencies, though having high audibility, may have considerably lower actual acoustic power. In averaging orchestral music it has been found that the average power in the three-hundred-cycle region is about ten decibels above that in the two-thousand-cycle region, and for this reason it is desirable in many cases to deliberately attenuate the low frequencies fed to

Fig. 3. Schematic diagram of the 40-watt, dual channel amplifier and volume expander.



the expander or compressor voltage control to make the electrical balance better over a wide frequency range. Use of a limiter is also possible.

Using combinations of the above elements, systems employing five or more channels may be constructed, with speakers placed on all four walls and the ceiling if so desired, and with changes in tone color and direction limited only by the ingenuity of the builder.

Fig. 3 is the schematic for an excellent basic system including two power amplifiers with a total power output of forty watts and a wide range volume expander. With slight modifications, this makes a very flexible unit as it may be used in the frequency division system described at the first of the article, with volume expansion applied to one or both of the channels, or in connection with an ordinary radio or phonograph to provide both volume and frequency range expansion. Though volume expanders have never seemed too popular in conventional systems, in multiple channel operation the effect is greatly intensified and more realistic, with best operation seeming to be achieved by placing the speaker fed by a conventional amplifier in the center of the room and the speakers from the high and low frequency amplifiers on opposite sides of the room. Between the quiet passages coming from a single source and the expanded passages coming from all over the room, the contrast is tremendous.

Aside from the expander, the amplifier itself features several novel aspects. A separate power supply is used for the screen grids of the power tubes as well as the driver stages and provides exceptionally good voltage regulation which results in lowered distortion and higher output. A special driver system is used in the push-pull amplifier as it was discovered speaker load impedance variations apparently produced distortion voltages on the grids of the 6L6's. For this reason, extremely low-value grid resistors are used, and the phase inverter is isolated from the output tubes. In listening tests, 6B4's were interchanged with the 6L6's, the difference being almost unnoticeable even though no inverse feedback is used.

In conclusion, the audio enthusiast will undoubtedly find that conventional single channel reproduction sounds dull and drab compared to a multiple channel system.

—30—

SAVE THOSE PARTS

DEFECTIVE selenium a. c.-d. c. rectifiers can be utilized as separate parts, and it is not necessary to dispose of them because they are not perfect.

Using a pair of lineman's pliers, take them apart, and you will find you have seven small, handy metal washers and one fiber washer. If the rectifier has round fins, you will have six large metal washers besides. . . . . G.R.J.

Within the Industry

(*Continued from page 24*)

sales representative for the Radio Division *Sylvania Electric Products, Inc.*, and in his new post, he will work closely with *Sylvania* radio dealers and distributors in Michigan, Ohio, Indiana, Illinois, Wisconsin, and Minnesota, making his headquarters at 20 N. Wacker Drive, Chicago 6, Ill. The **L. S. TAUFENBACH** organization will serve as sales representative for the Pacific Coast on behalf of the *Radion Manufactuing Corporation* of Chicago. **JAMES L. FOUCH** will direct the sales policy for distributor, industrial, and custom-built items in his new capacity as sales manager for the *Cinema Engineering Co.*, Burbank, Calif., in the fields of TV, broadcasting, and motion pictures. **MID-STATE TELEVISION DISTRIBUTORS CORP.** will distribute the *United States Television* video sets in the Dayton, Ohio, area, from its office at 1808 E. Third Street. In his capacity as sales manager of the Magnetic Recorder Division of *Air King Products Co., Inc.*, **AB WAXMAN** will expand his department's activities to further its program in the rapidly growing industry. **JOHN E. KANE,** with many years' experience in both retail and wholesale distribution of radios and appliances, will serve as district salesman for the eastern portion of the *R. W. Fordyce Company* of Ardmore, Pa., The *Fordyce Company* is the district merchandiser of *Bendix* radio and television for eastern Pennsylvania. **RAYMOND S. PERRY** has been appointed general sales manager of the *Federal Telephone and Radio Corporation,* Clifton, N. J. He will direct all commercial activities of *Federal,* the American manufacturing associate of the *International Telephone and Telegraph Corporation.*

* * *

GENERAL ELECTRIC COMPANY, under its education fund, has awarded research fellowships amounting to $18,460 to fifteen graduate students for advanced study.

Seven of the students received the Charles A. Coffin Fellowship for advanced study in electricity, physics, and the physical sciences. Eight other students were awarded the Gerard Swope Fellowship for advanced study in industrial management, engineering, the physical sciences, and various scientific and industrial fields.

The fellowships are awarded annually on a competitive basis to graduates of universities, colleges, and technical schools who have shown through previous work that they could undertake or continue advanced study either in this country or abroad. Funds for both the Coffin and Swope Fellowships come from the income derived from the $1,000,000 *G-E* education fund.

Members of the committee selecting the winners represented six leading engineering and scientific organizations in the country, and these were assisted by four representatives of the *General Electric Company,* among them Dr. W. D. Coolidge, director emeritus of the *G-E* Research Laboratory, and A. D. Marshall, secretary of the fund.

* * *

RAY RICE, former publicity director for *Raytheon Manufacturing Company,* has resigned to open his own office at 60 East 42nd Street, New York, N. Y.

Mr. Rice, who has served as publicity director for *Raytheon* for the past four years, retains his staff and has taken over the space previously occupied by the company's publicity department. He will continue, however, to handle the *Raytheon* publicity on an account basis, adding one or two other accounts at a later time.

* * *

VINCENT DE PAUL GOUBEAU was recently elected vice-president in charge of the materials department of the *RCA Victor Division, Radio Corporation of America.*

Prior to his joining *RCA* in 1945, Mr. Goubeau served for three years in the Navy Department, as Chief of the Contract Clearance Division, which he organized and administered until elevated to the post of Deputy Chief of Procurement, and later, Chief of Procurement.

Mr. Goubeau is past president of the New England Purchasing Agent's Association and a former director of the National Association of Purchasing Agents. He was born in New York City and attended the De La Salle Institute.

* * *

THE NATIONAL VIDEO CORPORATION, a new manufacturer of cathode-ray tubes, located at 3019 West 47th St., Chicago, Ill., is now in full operation. Straight-line production, covering over 518 continuous feet is accomplished in the 40,000 square-foot plant.

President of the company is Mr. A. Cole, who has been in the cathode-ray tube industry for twenty years. New, streamlined machinery and equipment was installed in the plant so that each tube may be produced with a maximum of efficiency. Rigid inspection is given each finished product to help insure perfect tube construction.

* * *

A. H. NICOLL, president of *Graybar Electric Company,* was recently elected president of the New York Rotary Club. A member of the Club since 1939, he stepped up from the office of first vice-president to succeed Harry D. Schmedes.

A member of the Rotary Club's Board of Directors for the past four years, he is also a member of the Executive Committee of the National Electrical Wholesalers Association, a Trustee of the Union Dime Savings Bank, a member of the Board of Gov-

ernors of the Union League Club of New York, and a member of the Advisory Committee of the Chase National Bank's Grand Central Branch.

-30-

"MARS" PROGRAM OPEN TO AMATEURS

MEMBERSHIP in the National Guard Military Amateur Radio System is open to any Guardsman or recruit who possesses an amateur radio operator's license, it was recently announced by Major General Kenneth F. Cramer, Chief, National Guard Bureau. MARS activities would be in addition to the regular weekly armory training of the National Guard and purely on a voluntary basis.

Under the plan, "radio hams" may now gain experience and training as members of the recently-authorized service-wide system which will establish amateur radio networks in the armed forces. It provides an opportunity for amateurs to become a part of the communications system that would play a vital part in the defense of the United States in case of emergency.

The National Guard network would fit into the nationwide service MARS network in this way: The amateur operators would work their own sets at home and report to their local MARS Station Director at the armory or air base, and he in turn would check into a state net by reporting in to the state MARS Director or net control station—there will be one each for the Army and Air Guard in each state. These in turn will be netted into the numbered Army or Air Force MARS Directors and then, in a final check, would net in with Headquarters at Washington, D. C.

Amateur radio operators interested in participating in the MARS program and who can qualify for membership in the National Guard should contact the Adjutant General of their respective states or the nearest Guard armory or air base.

-30-

ERRATA

In the article, "Audio Transient Distortion," page 39, April 1949 issue, the oscilloscope patterns shown at top of page were arranged incorrectly. The individual pictures should be from left to right, top to bottom, F, A, C, B, D, and E.

• • •

The screen and suppressor terminals on tubes V_1 and V_2, page 60, April 1949 issue, are shown in the wrong sequence. To correct the error, interchange these two terminals.

• • •

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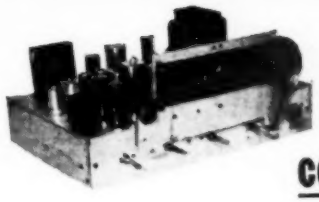

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- Input Jack for Crystal or high level magnetic type phono pickup
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INDEX OF Advertisers

JUNE 1949

[While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.]

Mobile TV UNIT

(*Continued from page* 53)

reaches the home station through the use of telephone circuits. On most remote broadcasts, a crew of 10 or 11 men is needed. In addition, personnel are needed in the TV control room and at the transmitter at Radio City.

Before the new mobile unit was received, two portable cameras had to be transported to the scene on ordinary trucks. As they were the only cameras for television which were owned by WTMJ-TV, it was quite a problem for the engineers to set up the portable cameras for both studio and remote broadcasts. Now two studio-type *RCA* cameras for television work have been received, making more extensive programming possible. Until the new cameras arrived, studio and remote broadcasts could not be scheduled in the same broadcast segment.

In the mobile truck, the following special equipment for TV operation in the field is installed: A complete 7000 megacycle microwave transmitter and its four-foot parabolic antenna; three complete television camera chains with synchronizing generators and master monitor switching and power supplies; complete remote audio amplifiers, with cases containing six different types of microphones for various types of broadcasting; compartments for camera tripods, announcers' video monitor and view finders; camera cable, 500 feet, on reels, 250 feet of power cable, and 500 feet of microphone cable. A complete power distributing panel with power metering and voltage regulators.

In November, 1948, the mobile unit made its longest trip to do a remote broadcast. This was to Wrigley field in Chicago for the Green Bay Packer —Chicago Bear game. Most broadcasts from Chicago are network programs, but this particular one was exclusive with WTMJ-TV and, therefore, all operations had to be handled by the station. At any rate, the mobile TV truck proved itself in the test. —30—

RELAYS

FOR EVERY PURPOSE

Over a Million in Stock!

Whether you require large quantities of relays for production runs or single units for laboratory or amateur work, Wells can make immediate delivery and save you a substantial part of the cost.

Our capable engineering staff is prepared to offer assistance in the selection of correct types to suit your exact requirements.

Each relay is brand new, standard make, inspected, individually boxed and fully guaranteed.

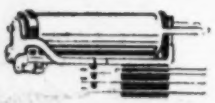
The following list represents only a tiny portion of our relay stock. Write or wire us for information on types not shown.

STANDARD DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-101	24V	1500.	DPST (NO)	Auto. Elec.	$1.35
R-102	24V	400.	SPDT	Auto. Elec.	1.10
R-103	24V	DUAL-1000	3PST (NO)	Auto. Elec.	1.35
R-105	24V	600.	3PST (NO)	Clare	1.20
R-106	24V	1300.	3PST (NC)	Clare	1.25
R-152	12V	50.	DPDT-SPST (NO)	Guardian	1.10
R-153	12V	200.	SPDT-SPST (NO)	Stromberg	1.25
R-154	12V	200.	SPST (NO)	Clare	1.20
R-155	12V	100.	SPST (4NO4NC)	Auto. Elec.	1.15
R-158	6V	50	4PST (NO)	Stromberg	1.10
R-159	6V	50	DPST (NO)	Stromberg	1.10
R-160	6V	12	3PDT-3PST (NO)	Auto. Elec.	1.05
R-161	6V	10	3PST (2NC-1NO)	Auto. Elec.	.90
R-121	150V	5000.	2PST (NO) SPDT	Clare	1.65
R-123	150V	6300	SPST (NO)	Clare	1.75
R-602	150V	6500	3PST (NO)	Clare	1.75
R-515	24V	750	SPST (NO)	Clare	1.25
R-517	12V	250	DPST (NO)	Clare	1.20
R-519	250V	84000.	SPDT	Auto. Elec.	1.95
R-520	250V	84000	DPDT	R.B.M.	2.10
R-521	32V	1000.	DPDT	Kellogg	1.20
R-166	24V	DUAL-200.	DPDT-SPST (NO)	Stromberg	1.59
R-168	24V	DUAL-200.	4PST (NO)	Auto. Elec.	1.20
H-240	250-350V	40000	DPST (NO)	Auto. Elec.	2.95
H-241	48V	650	SPDT-SPST (NO)	Clare	1.25

TYPE 18 DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-109	24-48V	4000.	SPDT	Auto. Elec.	$1.50
R-110	24-32V	3500	SPDT	Auto. Elec.	1.50
R-112	90-120V	6500	SPST (NC)	Auto. Elec.	1.75
R-114	24V	500	4PST (NO)	Auto. Elec.	1.30
R-603	24V	400	DPST (NO)	Auto. Elec.	1.25
H-238	24V	150	DPDT-SPST (NC)	R.B.M.	1.25
H-239	24V	180	DPST (NO)	Auto. Elec.	1.25



SEALED DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-125	24V	300	DPDT	Clare	$2.75
R-126	90-120V	2000	DPDT	Clare	3.00
R-504	24-70V	2800	SPDT	GE-C103C25	3.00

V TYPE DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-164	24-32V	1000.	SPST (NO)	W.E.	$1.20
R-512	24-48V	3500	DPDT	W.E.	1.30
R-513	12-24V	300	DPDT-DPST (NC)	W.E.	1.20
R-514	4-6V	60	SPDT	W.E.	1.05
R-526	6V	35	DPDT-SPST (INC-1NO)	W.E.	1.05

AC-STANDARD TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-212	90-135V	—	NONE	Clare	$0.95
R-213	5-8V	—	DPST (NO)	Clare	4.50
R-605	24V	—	3PST (NO)	Auto. Elec.	.95
R-606	24V	—	DPST (1NO-1NC)	Auto. Elec.	.95
R-607	24V	—	SPST (NO)	Auto. Elec.	.95

DIRECT CURRENT MIDGET RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-132	24V	300	DPDT	Clare	$1.20
R-133	24V	300	NONE	Clare	.60
R-134	24V	250	4PDT	Clare	1.20
R-135	24V	300	SPST (NC)	Clare	1.15
R-137	24V	300	SPDT	Clare	1.15
R-138	24V	300	4PST (NO)	Clare	1.15
R-139	24V	200	4PDT	Clare	1.15
R-140	24V	280	SPDT	R.B.M.	1.15
R-141	24V	280	3PST (NO)	R.B.M.	1.15
R-142	24V	400	DPDT	Allied Cont.	1.20
R-143	24V	280	SPST (NO)	R.B.M.	1.15
R-144	24V	250	SPST (NO)	Allied Cont.	1.15
R-145	24V	300	DPST (NO)	Allied Cont.	1.15
R-146	12V	126	DPST (1NO) (1NC)	Clare	1.10
R-147	9-14V	75	SPDT	Guardian	1.05
R-148	12V	100	DPDT-SPST (NC)	Price Bros.	1.10
R-149	6-8V	45	SPST (NC)	Clare	1.00
R-150	6V	30	SPST (NO)	E-Z Elec.	.95
R-522	2-6V	2.	SPST (NO)	R.B.M.	.65
R-523	90-125V	6500	DPDT	Clare	1.90
R-222	12V	100	DPST (NO)	P & B	.95
H-242	24-32V	300	DPDT	R.B.M.	1.20
H-243	24-32V	300	4PDT	R.B.M.	1.20

SENSITIVE DC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-218	4-6V	1800.	SPDT	Kurman 220C	$1.95
R-220	75V	5000	SPDT	Allied Cont.	1.20
R-221	18-24V	5000	SPST (NO)	Allied Cont.	1.15
R-174	250V	5000	DPST (NO)	G.M.	1.85
R-175	350V	11000	DPDT-DPST (NO)	G.M.	2.95
R-176	24V	250	DPST (NO)	G.M.	1.50
R-177	24V	300	4PDT	G.M.	1.65
R-600	8-12V	5000	SPDT	S-Dunn-KS	2.10
R-507	24-48V	1000	SPDT-DPST (NC)	Guardian	1.15

TYPE 80 DC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-169	24V	250	SPST (NO)	Allied Cont.	$1.95
R-171	24V	230	DPDT	Allied Cont.	2.15
R-172	5-8V	30	DPDT-SPST (NO)	Allied Cont.	1.70
R-173	2-6V	5	SPST (NO)	Allied Cont.	1.25
R-529	24-48V	1000	DPDT	Allied Cont.	2.50

TYPE BJ QC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-204	12V	65	DPST (NO)	Allied Cont.	$1.15
R-205	24V	260	DPDT	Allied Cont.	1.25
R-224	12V	75	SPST (NO)	Allied Cont.	1.15
H-237	27V	230	DPDT	Allied Cont.	1.25

HEAVY DUTY KEYING RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-248	28V DC	150.	SPST (NO) 10A.	Guard. 36471	$1.05
R-244	75V AC	265	SPST (NO) 20A.	Leach 1327	1.75
R-206	24V DC	158	SPDT-3 AMP.	P&B-KL	1.20
R-207	24V DC	210	4PDT-3 AMP.	P&B-KL	1.10
R-219	5CV DC	1500	DPST (NO) 15A.	P&B-SP	1.25
R-217	115 AC	600	SPDT-10 AMP.	St. Dunn 1XAX	2.25
R-525	24V DC	200	DPDT-10 AMP.	Guard. 34464	1.25
R-508	110 AC	600	SPDT-6 AMP.	Guard. 37189	1.95
R-506	24 V DC	300	DPST (NO) 6A.	—	.95
R-510	24 V DC	200	3PDT-10 AMP.	Guard. 516983	1.05
R-604	24 V DC	200	SPST (NO) 30A.	St. Dunn-B2A	1.75
H-608	115 AC	—	SPST (NO) 20A.	St. Dunn-1HXX	2.25
R-620	12V DC	35	3PST (NO) 10A.	Guard-BKZ	1.05
R-223	28V DC	150	SPST (NO) 40A.	Price Bros.	1.35
H-230	12-24V DC	80.	DPST (NO) 10A.	—	1.20
H-231	24V	230.	DPST (NO) 5A.	R.B.M.	1.15

DC-TYPE 76 ROTARY RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-197	9-16V	70	DPDT	Price Bros.	$1.65
R-198	9-16V	125	6PST (3NO) (3NC) SPDT	Price Bros.	1.65
R-199	24-32V	250	SPDT-DPST (NC)	Price Bros.	1.65
R-200	24-32V	275	3PDT-SPST (NC)	Price Bros.	1.65
R-201	24-32V	250	DPST (NO) SPDT (NC) DPDT	Price Bros.	1.65
R-601	9-14V	60.	3PST (NO)	Price Bros.	1.65

DIRECT CURRENT KEYING RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-190	12V	65	DPDT 10 AMP	Advance Elec. Type 2000-A	$1.15
R-191	28V	125	DPDT 10 AMP	Guardian	1.20
R-192	12V	44	3PDT 10 AMP	Allied Cont. Type NB5	1.35
R-193	5-8V	11	DPDT 10 AMP	Leach	
			SPST (NO)	Type 1027	1.05
R-194	24V	265	DPST (NO) 10 AMP	Leach Type 1054SNW	1.25
R-195	6V	32	DPDT 3 AMP	G.E.Co.	1.15
R-196	12V	50	DPDT 10 AMP SPST (NC)	Guardian	1.15
R-242	24V	170	SPDT 2 AMP	Leach Type 1253DEW	1.25
H-236	5-8V	10.5	SPDT 10 AMP	Leach-BFM	1.05

CUTLER HAMMER HEAVY DUTY CONTACTORS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-178	24V DC	100	SPST (NO) 100A.	6141H34A	$3.45
R-179	6V DC	6.5	SPST (NO) 50A.	6041H83A	3.00
R-180	12V DC	25.	SPST (NO) 50A.	6041H308	3.25
R-181	24V DC	65	SPST (NO) 100A	6041H88	3.45
H-232	24V	55.	SPST (NO) 50A.	Metal Cased	3.25
H-233	6V	15	SPST (NO) 50A.	Metal Cased	3.15
H-235	24V	70.	SPST (NO) 100A.	Type B6	3.85

DIRECT CURRENT AIRCRAFT CONTACTORS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-182	28V	80	SPST (NO) 25 A.	Guardian	$1.85
R-183	24V	60	SPST (NO) 50 A.	Allen Bradley Type B6A	2.75
R-184	28V	50	SPST (NO) 100A.	General Elec.	2.95
R-185	24V	100	SPST (NO) 50 A.	Leach 5055ECR	2.75
R-186	24V	132	SPST (NO) 50 A.	Leach 7220-3-243	2.50
R-187	24V	100	SPST (NO) 50 A.	Allen Bradley	2.95
R-188	24V	200	SPST (NO) 75 A.	Allied Cont.	2.95
H-234	14V	45	SPST (NO) 30 A.	—	1.65

ANTENNA CHANGEOVER RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-192	6-12V DC	44	2PDT 10 AMP	Allied-NBS	$1.35
R 231	12VDC	100.	DPDT 6 AMP	G. E.	1.99
R-256	24-32V DC	—	SPDT-DPST (NC) 1KW	Guardian	1.45
R-501	110 AC	4	DPDT (1KW)	G. E.	2.45
R-503	12-32V DC	100	SPDT-5PST	G. E.-500 W.	1.95

COMBINATION PUSH BUTTON AND REMOTE RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
H-244	12-24 V DC	Dual-60	SPDT	CR2791-R106C8	$1.65

ADJUSTABLE TIME DELAY RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-246	115 AC		SPST (NO) or (NC) 10 AMPS	R. W. Cramer 1-120 Sec.	$8.95

DC MECHANICAL ACTION RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-245	12V	25.	4" Lever	G.M.	$0.95
R-527	6-12V	200.	2" Lever	—	.95

TYPE C.M.S. RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-511	24V DC	200	MICRO-SW. SPST (NO)	Clare	$2.45

DC CURRENT REGULATOR

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-509	6-12V DC	40	SPST (NC)	G.E.	$0.85

LATCH AND RESET RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-500	12V DC	10.	DPDT-10 AMP	St. Dunn-CX-3130B	$2.45

DC-ROTARY STEP RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-621	6-12V	30.	3 POLE 23 POSITION	W. E.	$10.95

DC-RACHET RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-230	5-8V	2.	SPDT-DPST (NO)	Guardian	$2.15

Special Sample Engineering Offer

Any ten relays listed (one of each type) with the exception of Stock Nos. R-621 and R-246—only $10.00.

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